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The Telephone Not a Telegraph.

The recent decision by the federal court of last resort in the Richmond case, to the effect that telephone companies do not come within the Act of Congress of 1866, may make considerable difference to the telephone interest. That act, it will be remembered, gave telegraph companies power to run their lines on any military or post road, etc., and as that means pretty well every street, the telegraph companies found their example closely imitated by their telephone friends in the use of such thoroughfares, under the highly natural assumption that the telephone is a telegraph. It happened, however, that in Richmond, Va., an independent telephone company wanted joint use of the Bell poles, and this being refused, the city took a hand in the matter and set the law in motion on the ground that the Bell company had not acquired local permission for the erection of its poles and wires and did not come under the Act of 1866, which would have exempted it from local ordinance.

Judge Harlan said in his opinion on behalf of the court, that perhaps if the telephone had been known in 1866, it might have been specifically included by Congress. We must confess that to us this is as though in defining electric lighting a radical distinction should be made between arc and incandescent. The transmission of intelligence by signals and speech is telegraphy, and the striking feature is that the general telegraph to-day is a telephone, the operators reading by sound.

In one aspect of this important case, this is, of course, a victory for the independent telephone company, but it would be narrow to regard it altogether in that light. Such a victory may be of the pyrrhic type, and now that the decision has been rendered it looks to us as though the telephone companies of whatever name or stripe would do well to get together and secure such legislation as will bring them within the Act of 1866. The initiation of work to that end is well worthy of the consideration of the important meeting of the Independent Telephone Association, which takes place next week in Chicago. The advantages of that Act are too great to be neglected.

The Automobile in Politics.

One of the latest items of news from France is that the automobile Club of Paris, the French authoritative body on "horseless" subjects, has been closed up temporarily because the recent conspiracy to knock President Loubet through his silk hat was concocted there. It is a little bit difficult to trace the connection between automobiles and national politics, but if certain actions are continued much longer, they will beyond question soon play a part in local politics in New York and Chicago. The opposition of the New York park authorities towards them is highly ridiculous, but must be dealt with at this time as very serious.

Out in Chicago, strange to say, the same stupid opposition is shown by the park authorities. The South Side Park Board which

manages the South Side boulevard and park system has passed a resolution prohibiting the use of automobiles on the boulevards and in the parks. This South Park boulevard system, as is well known to those familiar with the city, is of great extent, including Jackson Street, right through the centre of the town, and Michigan Avenue from Jackson Street south. We believe the edict is to be fought, and are glad to note meantime that the public and the newspapers are bestowing an abundance of sarcastic comment on the board. The Chicago *Herald,* which four or five years ago was public spirited enough to organize a prize automobile contest, has embarked on a campaign against the board and is pushing the fight right smartly. It is the horse that must go; not the automobile.

A MILLION FOR AN INVENTION.

President Glidden, of the Erie Telephone system, has made the definite offer, that he will pay one million dollars for a telephone repeater which will be as efficient in telephony as the telegraph repeater is in telegraphy. Attractive as this offer is, the fortunate inventor would probably receive still more attractive ones should he solve the problem of telephone relaying as completely as the proposition requires. From the earliest days of telephony the great inventive prize in that field has been the telephone repeater, and therefore those who would now undertake to gain it should realize that they follow many able inventors whose efforts have been futile. As early as 1878 Prof. Hughes thought he had solved the problem of telephone relaying, and Edison at one period gave the subject much attention, taking out a number of patents. Profs. Thomson and Houston, Gilliland, Farmer, Bennett, Patten and about two-score other men figure in the patent records as seekers after the prize. It may therefore be taken for granted that the solution of the problem—if solution there be—will be one not involving merely obvious combinations of telephone elements, but most probably lying in a direction not yet explored nor even yet discovered.

To receive speech at the end of a long relayed line as satisfactorily as at the end of a short direct line, implies first, the addition of energy to the voice-current after it leaves the transmitter spoken into, corresponding at least to the energy lost on the line and in the interposed instruments; and second, the maintenance of the original form of the voice-current. The form of current in the transmission of speech is very complex, the periodicity varying within very wide limits and therefore subjecting the elements of the current to unequal effects with respect to distortion. Consequently, a means that might succeed in adding sufficient energy to supply that lost in transmission, would not necessarily solve the problem; that is, a solution for musical notes would not necessarily be one also for speech. Another consideration not to be lost sight of is that but a feeble portion of the mechanical energy expended at the transmitter reappears at the receiver diaphragm, and therefore to duplicate at the relaying transmitter the original effect implies a further introduction of energy into the circuit. Those who would look up the work that has already been done in connection with this enticing subject are referred to an article by Thomas D. Lockwood on "Telephone Repeaters or Relays, and Repeating Systems," which appeared in THE ELECTRICAL WORLD of Nov. 14, 21 and 28, 1896; and to an article by Lieut. F. Jarvis Patten on "The Telephone Repeater," in THE ELECTRICAL WORLD of May 22, 29 and June 5, 1897.

BENJAMIN FRANKLIN.

The statue of Benjamin Franklin unveiled at Philadelphia last week was a tardy tribute to one who stands first on the roll of the Quaker City's great sons—in this case an adopted son. The wide scope of Franklin's genius was illustrated in the address delivered on the occasion, for though his is one of the greatest names in electrical science, the orator, embarrassed by a richness of material, found time for but a passing reference to its connection with electricity. A brief glance at the work he accomplished in this field will therefore not be inappropriate at the present time. While the work of Franklin's predecessors from Gilbert and Guericke to Gray and Dufay had more or less of intrinsic value from a scientific point of view, and furnished inspiration which led to great advances, the many-sided Philadelphian first brought to electrical investigation the modern practical spirit which is not satisfied with mere brilliant experimentation and lofty speculation, but has for its final aim the definite determination of nature's phenomena and, where possible, their adaptation to the service of man. His interest in electricity was apparently first awakened by the discovery of the Leyden jar, and in a beautifully scientific series of experiments he proved that the power of giving a shock lies in the glass itself and not in the metal coatings. As a deduction from his theory of electricity he concluded that jars might be charged in parallel and discharged in series. On this principle he constructed batteries which for the first time enabled the magnitude of electric force to be appreciated, and led him to write "There are no bounds to the force man may raise and use in the electrical way; for bottle may be added to bottle and the greatest known effects of common lightning may, I think, without much difficulty be exceeded in this way." Franklin's work in this direction doubtless led him to the consideration of the nature of lightning. Though not the first to suggest the identity of lightning and electricity, it remained for him to prove the identity, and to propose the theory of the lightning rod and to put it into practice. Finally, Franklin's single fluid theory of electricity formed the basis of all electrical thought for more than a century, this alone assuring him a commanding place for all time in the history of the science.

When we consider that his work in electricity was but a mere episode in the life of Franklin, extending over but a few years of his life, there is only wonder at the immensity of his genius. The effect of the work of Franklin in accelerating the building up of electrical science cannot be over-estimated. Priestley in 1759 wrote: "Nothing was ever written upon the subject of electricity which was more generally read and admired in all parts of Europe than these letters (to the Royal Society). There is hardly any European language into which they have not been translated; and, as if this were not sufficient to make them properly known, a translation has lately been made into Latin. Though the English have never been backward in acknowledging the great merit of the philosopher, to form a just idea of the great and deserved reputation of Dr. Franklin, we must read the foreign publications on the subject of electricity; in many of which the terms *Franklinism, Franklinist* and *Franklinian system* occur on almost every page."

ELECTROMAGNETIC WAVES IN FREE SPACE.

An article which appears in another part of this issue is of interest as showing that electric waves can be detected by apparatus other than the coherer or the spark gap. The article contributes but little quantitative information, either as to the delicacy of the receiving apparatus employed or as to how far it approaches the spark gap in sensitiveness, but it is certain that the coherer has been made far more sensitive than the spark gap up to the present time. After the introduction of the electromagnetic telephone, which excited so much wonder and astonishment, it was found that all kinds of telephones could be made. Thermal telephones, electrostatic telephones, electromechanical telephones, hydroelectric telephones were all discovered, and in fact the difficulty was to find some branch of electric science which could not be made to serve in some way for the production of a telephone receiver. Now that electromagnetic waves have been

fully established, and the receiver for them has been found, it is most likely that the difficulty in the future will be to find some branch of physics that it incapable of producing a receiver for them. At the same time, it is well to remember that the only practical telephone in use is the electromagnetic telephone, and it is probable that in the same way some particular form of electric wave receiver will be found which will reveal its superiority over those of other types.

It is well known that an electrified surface exerts a hydrostatic pressure outwards in the surrounding medium. The rapid cohesion and release of this pressure should reasonably produce a rhythmical disturbance capable of affecting the air, when within the proper limits of frequency. It is this disturbance which seems to be the active principle in Dr. Kitsee's receiver. The disturbance is in some cases so good that we know an electric conductor conveying alternating currents emits powerful glow when its pressure is maintained at something like 5 kilovolts. It may be that such a wire may emit a feeble crepitation, although we are not aware that such an effect has been noticed. The more numerous the means which are found to be available for revealing the presence of electromagnetic waves of moderate frequencies, the more rapid should be the development of the theory and practice of this interesting branch of applied electricity. We know of two characteristic types of electric waves—those which run along a pair of electric conductors through the intervening dielectric, and constitute by their motion electric currents, and those which radiate uniformly in all directions and which correspond to the vibrations of light. Wireless telegraphy is developing an intermediate form, in which, owing to the conducting surface of the earth or ocean, electric waves are propagated through the atmosphere and ether, partly in all directions but largely in a horizontal zone.

Much yet remains to be done to determine the influence which the conducting earth exerts upon the distribution of electromagnetic waves in free space over its surface. It is declared by several observers that electromagnetic waves are carried to a noticeably greater distance with recognizable intensity over water than over solid ground. If this is a fact, the difference may be attributed either to the greater conductivity of the ocean over the ordinary surface of the soil, or to the more nearly uniform level surface of the ocean or to both causes combined. Recent discoveries in the direction of electromagnetic waves indicate not only the limitations of the human eye, in regard to its capacity for detecting these waves, but also the room for a coherer eye, or corresponding organ which would be equivalent to an entirely new sense. It is only reasonable to suppose that the ether may be replete with low frequency vibrations which only a coherer could detect, as well as with those higher-frequency vibrations of light upon which our powers, our pleasures and our very existences so greatly depend. It is even conceivable that beings might exist in some parts of the universe, possessed of an organ capable of responding to the lower frequency electromagnetic waves to which our own senses are blind. The same remark might apply to ultra-ultra violet radiations in the form of say Becquerel or Röntgen rays.

COMPARATIVE OPERATION OF RELAY AND MAGNETO TELEPHONE SWITCHBOARDS.

In spite of the fact that the introduction of a common battery or relay switchboard in place of one of the older types involves the rebuilding of almost the whole of the telephone system, the new style of board is rapidly coming into use in the Bell Telephone exchanges in this country. The reasons for this great outlay so willingly made by the telephone companies are not hard to find. On such a board the response to a call and the method of completing a connection are practically the same as on one of the magneto type, but the amount of supervision necessary on the part of the operator is reduced and rendered less difficult. The connection once made to the line called for, it is not necessary for the operator to break into the wire from time to time and ask, "Got them yet?" or later, when she thinks the conversation may be completed and the ringing off neglected, to cut in and ask, "Through yet?" The disconnecting signal is positive, and cannot be mistaken for a repeated call on the part of the calling subscriber. It is only necessary for the operator to watch the supervisory lamp, and, if the call is not promptly answered, to repeat it by pressure upon the ringing cam until the extinguishment of the lamp indicates that the subscriber called for has removed his telephone from the hook. After this, when both supervisory lamps again light up, she takes down the connection without having to inquire whether the conversation is finished or not. Even this small amount of supervision may be further reduced by means of a device recently patented, whereby the ringing generator is automatically connected to the line of the wanted subscriber as soon as the plug is pushed into the jack of that line, and kept connected there until that subscriber removes his telephone from the hook.

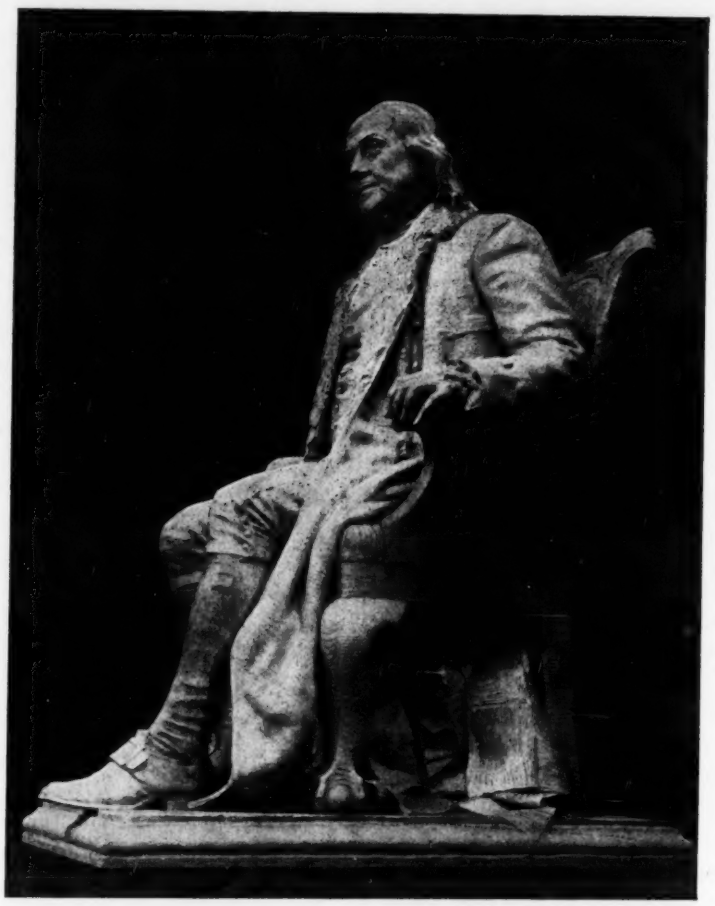
This great reduction of the supervision has three beneficial results: In the first place, it keeps the operators out of the lines entirely while they are in conversational use, rendering the service more secret and reducing the interruptions of careless operators who cut in and question without listening. Having no excuse for going into the wires, and being under the supervision of the monitor operators, the answering operators would rarely listen in, even should they desire to do so. The trunk-line operators on the new boards have no facilities whatever for listening to what is passing in the circuits. The second of the three benefits mentioned is the reduced amount of conversation, noise and apparent confusion in the operating room, while the third, and by far the greatest, is the increased capacity of the operators. On a board recently installed in New York City each answering operator attends to the lines of 140 subscribers, a great increase over the number per operator's position customary on magneto boards, which runs from fifty to seventy-five. In general, it may be said that an answering operator may attend to twice as many subscribers with the improved board as with the magneto type, practically cutting in two the cost, complexity and trouble of the cumbrous multiple boards in large exchanges, as well as the operating expenses thereof.

At the subscriber's instrument connected to one of the new boards, the conditions are improved by the elimination of the ever-troublesome primary battery and the substitution therefor of an unfailing source of 100 milliamperes of current per microphone. The manipulation of the instrument is also simplified, but this, at first, proves perhaps more of a disadvantage than an advantage, as the nervous, irritable, impatient subscriber has no crank on which he can work off his vengeance, but must patiently wait if "central" is not perfectly prompt. The ringer coils of the magneto bells also get a uniform current, as they are always rung from an unvarying electromotive force at the exchange, and all lines have the same standard resistance.

The lines must be put up and maintained with more care for common battery systems, as line troubles interfere more seriously with their working than with that of magneto exchanges. There being always a potential difference of some 25 volts between the two wires of each line, the crossing or grounding of wires gives false signals and worse confusion than in case the lines are normally dead. With the improved construction of present practice, and particularly with underground work, these troubles are sufficiently infrequent to be but a slight objection against the improved system.

A Statue of Franklin Unveiled in Philadelphia.

A bronze statue of Benjamin Franklin was unveiled in Philadelphia on Wednesday, June 14. It is the work of Sculptor J. J. Boyle, and was given to the city of Philadelphia by a prominent resident named Mr. Justus C. Strawbridge. The presentation ceremonies were conducted under the auspices of the University of Pennsylvania, the American Philosophical Society, the Franklin Institute, the Library Company of Philadelphia, the Historical Society of Pennsylvania and the Pennsylvania Hospital. Addresses were made by several well-known men and the cord that held the flag which covered the statue was drawn by Miss Margaret Hartman Bache, who is a descendant of the great philosopher, statesman and scientist. The oration was delivered by United States District Attorney James N. Beck, in the Chestnut Street Opera House, after which the party proceeded to the statue, where the unveiling and presentation speech was made by Postmaster-General Charles Emory Smith, for Mr. Strawbridge, and the statue was accepted by Mayor Ashbridge. In presenting the statue Postmaster General Smith spoke of the generous beneficence of Franklin, his distinguished services and his modesty. "He was," the speaker said, "the founder of the nation and a citizen of the globe. In many-sided greatness he was the foremost man in the nation." Mr. Smith referred to the various societies with which Franklin was associated and his achievements in politics, philosophy and science.



THE BOYLE STATUE OF FRANKLIN.

The ceremonies were in charge of a committee consisting of Provost C. C. Harrison, of the University of Pennsylvania; Dr. Coleman Sellers, of the Philosophical Society; John Birkinbine, of the Franklin Institute; Joseph G. Barnwell, of the Library Company, Philadelphia; Judge Pennypacker, of the Historical Society of Pennsylvania, and B. A. Shoemaker, of the Pennsylvania Hospital. All of these institutions were formed by or had some direct connection with Franklin.

The oration of Mr. Beck was devoted mainly to a discussion of the intellectual greatness of Franklin and his unequaled versatility. He referred to Franklin as a young printer of 33 years of age, 160 years ago. "Franklin was the incarnation of democracy," the speaker stated, "the first of the self-made men of America, and the greatest when the versatility of his genius is considered. He was, moreover, a typical American, combining with Abraham Lincoln, more of the characteristics of our people than any great man in our history."

At the conclusion of the oration of Mr. Beck, Mayor Josiah Quincy, of Boston, made an address. He referred to Franklin's birth in Boston, and stated that the bequest left at his death now reached $300,000. The manner of disposing of it was now being considered. The statue stands in the south plaza of the post office.

Independent Telephone Association.

As already announced in these pages, the Independent Telephone Association of the United States will hold its third annual convention next week, at the Auditorium Hotel, Chicago, June 26, 27 and 28. The programme, which has been printed, promises a useful meeting, and the attendance bids fair to be large and representative. The sessions will be supplemented by excursions and festivities.

Mr. Glidden on the Growth of Telephony.

"The telephone business in the United States," said Mr. C. J. Glidden, president of the Erie Bell Telephone system, "is increasing at a rate which exceeds anything in its history. The subscribers of the Erie system alone are increasing four thousand a month. I know of no other reason for this remarkable growth than the general business revival throughout the country. I have noticed, however, that the greatest development is along the Pacific coast, in Washington, Oregon and California. Four per cent. of the population there have telephones. In proportion to its size San Francisco has more telephones than any other city in the United States. It has fourteen thousand instruments, which is 5 per cent. of its population. On this basis New York should have one hundred and fifty thousand instruments

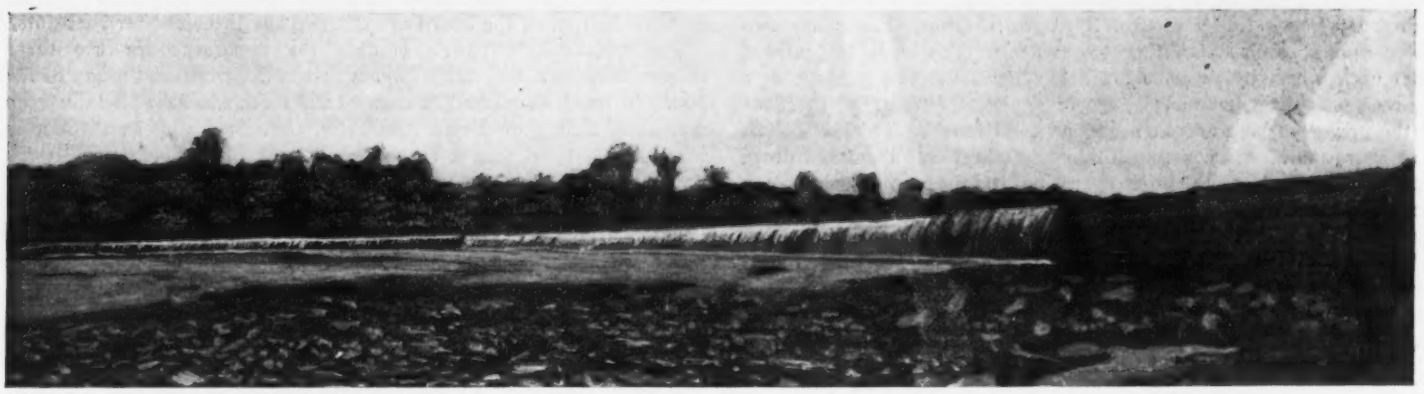
"The long-distance service now reaches to Galveston, Tex., in the Southwest; Grafton, N. D., in the Northwest; New Orleans in the South, and the extreme northeastern sections of Maine. The extreme points have not yet been put into commercial connection with each other, the direct use at present being confined to distances of 1500 and 1800 miles. I think the capacity of the No. 8 copper metallic circuits now in use is about 2000 miles. A circuit which would permit of a direct connection between here and San Francisco would require copper wire at least as large as an ordinary broom handle.

"In the present circumstances I cannot see where there is room for any phenomenal developments in the telephone system. Now, if some one would invent a telephone repeater, corresponding to the telegraph repeater, or a telephone quadruplex, corresponding to the telegraph quadruplex, it would revolutionize our business and cut the charges in two for long-distance service. Copper wires would not be necessary then, and the reduction of the cost of maintaining the lines would be enormous. I will give $1,000,000 for either one of these inventions."

American Institute of Electrical Engineers.

Secretary Pope has now issued the final revised preliminary programme of the meeting which begins at the Massachusetts Institute of Technology, Monday, June 26, at 10 a. m., and which will be continued on Tuesday and Wednesday. Fourteen papers are provided, in accordance with the list already given in these columns and including four new items. One is a paper on "Operating Costs of Horse and Electric Delivery Wagons in New York City," by R. A. Fleiss, of Columbia University, and another is "Electric Automobiles," by Elmer A. Sperry, of Cleveland. In addition, there is a paper not previously announced, by Prof. F. A. Laws, of Boston, on "An Apparatus for Photographing Periodic Current Waves," and one by A. D. Adams, of Boston, on "Motor Regulation." The headquarters for the week will be the Hotel Brunswick, Boston, and several interesting trips have been arranged for the afternoons and evenings. Members from New York and vicinity will preferably leave by the Fall River boat, "Puritan," on Sunday, June 25, at 5:30 p. m.

CANADIAN ELECTRICAL ASSOCIATION.—The annual meeting of this association will be held at New Royal Hotel, Hamilton, Ont., on June 28-30. The programme has already been given.



Three-Phase Power Transmission at St. Hyacinthe, Quebec, Canada.

BY E. M. ARCHIBALD.

THE oldest transmission plant in Canada employing a three-phase system is that in St. Hyacinthe, in the Province of Quebec, Canada, a city of 13,000 inhabitants, mostly French, distant about 40 miles from Montreal. In April, 1894, La Compagnie des Pouvoirs Hydrauliques de St. Hyacinthe—or the St. Hyacinthe Hydraulic Power Co.—was formed with the object of generating electrical power by utilizing the rapids on the Yamaska River and transmitting it into the city of St. Hyacinthe for illuminating and power purposes. By Christmas of the same year, the incandescent light had made its appearance there. This river Yamaska takes its source far back amongst the Green Mountains of Vermont and its onward flow is fed by numerous small streams until it reaches the majestic St. Lawrence.

Situated five miles from the city of St. Hyacinthe, there was an old grist mill which had been operating for years by water power, a small head being obtained by damming up the river at the Flat Rapid. This property the company secured and began improving the water power by raising the dam three feet, widening the head race from 15 to 40 feet, and by digging a tail race. The river at this point is 600 feet wide and one part of the dam has been built half way across, after which it turns slightly and runs obliquely towards the shore, thus making an entrance for the head race. This may be seen in the cut at the head of this page. This dam is of cribwork, in a triangular shape, filled in with cobblestones, 9 feet deep and 22 feet thick at the bottom. The up-stream side slopes upwards to the water surface and is 24 feet long, being the hypotenuse of a right angled triangle of the above dimensions. The timbers in its construction are all very large, those in front being 18 inches square. The side sloping upwards to the crest, 24 feet long, is lined with 3-inch planks 12 feet long, placed end to end, at the upper end of which iron plates ⅜-inch thick and 3 feet long are nailed in place across the whole length of the dam. These are used on account of the ice and rubbish which, passing over the crest, would otherwise injure it. This cribwork is also filled in with cobblestones.

In summer, when the water becomes scarce, planks 14 inches wide are placed edgewise on the crest of the dam to raise the head of water by preventing any waste. The wing dam, extending from the beginning of the head race to the bottom of the tail race, a distance of 2000 feet, is also built of cribwork similar to the main dam, but is much higher and wider. The head race, originally 15 feet wide, is now increased to 40 and is 500 feet long, the sides being all boarded up. At the entrance a wooden boom 2 feet deep extends diagonally outwards, thus sweeping all ice and rubbish out towards the middle of the river and over the dam. A short distance further down four head gates, operated by a rack and pinion, control the supply of water entering the head race, while at the termination wooden racks prevent any rubbish which may have passed the boom from entering the wheel flumes. Four other wooden head gates 6 inches thick are placed at the entrance of the wheel flumes, operated by gearing inside the power house. A waste gate at the termination of the head race allows of the disposal of all rubbish and dirt which may have entered.

The tail race, 40 feet wide and 1500 feet long, has been excavated from the solid rock by blasting. A head of 16 feet has been obtained by thus increasing the height of the dam and by excavating a tail race.

The plan adopted for uninterrupted power is that of having a steam auxiliary plant, which may be used should the water become too low or should there be any trouble experienced with frazil and anchor ice. When in small quantities the frazil is swept over the dam by the greater current there, but it cannot thus be disposed of when in great quantities, on account of the frazil then tending to diminish the current from its very density. Anchor or ground ice is also encountered, this being the ice that forms on the rocks at the bottom. When this occurs the steam plant is put in operation until the morning's sun raises the temperature. Then the anchor ice rises immediately to the surface and is removed through the waste gate.

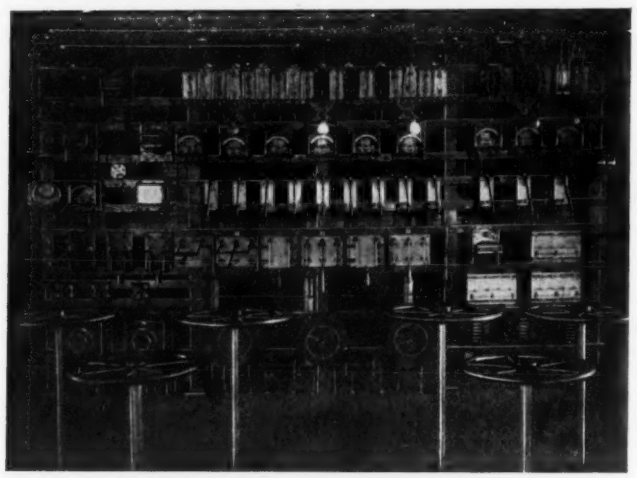


FIG. 1.—SWITCHBOARD.

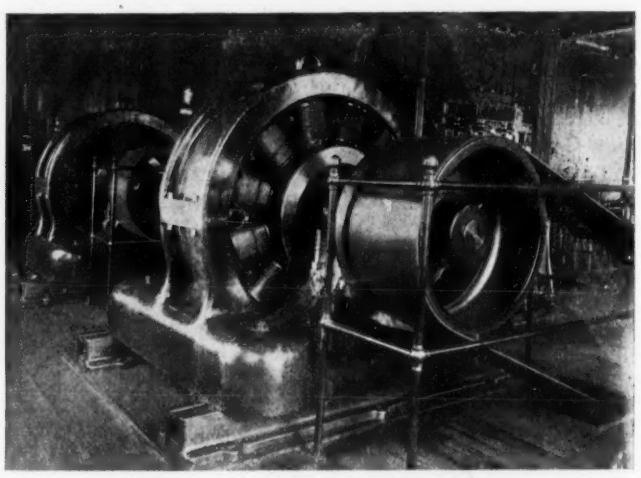


FIG. 2.—180-KW, THREE-PHASE GENERATOR.

The power house is a wooden one-story structure 150 feet long by 60 feet wide, extending from the outside of the head race on the wing dam to some distance on the shore. It is in three parts, the first situated on the head race being still a grist mill, not in operation, however, at present; the second, the power house proper, containing the electrical apparatus, and lastly the steam plant. The cobblestone foundations are laid on the bed rock, 12 feet below the ground surface.

The hydraulic equipment consists of four 50-inch Samson wheels of the vertical type, each capable of developing 225-hp, under a head

of 16 feet, and running at 95 revs. per minute, manufactured and installed by James Leffel & Co., Springfield, Ohio. There are two water flumes, each containing two wheels. Power is transmitted from each wheel by means of a heavy bevel mortise gearing to a 5⅝-inch jack-shaft, running at 300 revs. per minute, under the floor of the power house and extending its total length. This jack-shaft is in four separate sections, such that any wheel may be closed down without interfering with the operation of the remainder. Each section is connected to its neighbor by a rigid coupling keyed to the shaft and yet movable to and fro on it by means of a lever.

When it becomes necessary to couple one section to that already running, water is gradually let into the wheel by opening its gates slowly, and as soon as the wheel attains the correct speed the coupling attached to its section of shaft is moved along by the lever until

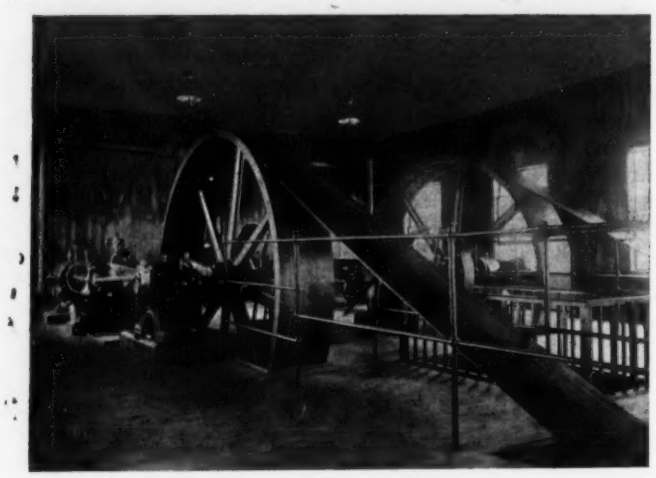


FIG. 3.—ENGINE ROOM.

it engages with the opposite coupling and then locked in position. The guide blades for each wheel controlling the quantity of water are connected together, all operating at the same time and controlled by means of a regulating wheel situated in front of the switchboard in the power house above.

Connected closely to the jack-shaft are three pulleys, each belt-connected to a generator on the floor above, which may be thrown into operation by means of three large Hill friction clutches, each controlled by a wheel placed in front of the switchboard, by which it may be engaged or disengaged. Another pulley is placed on the jack-shaft belt-connected to a pump used for fire purposes only. The jack-shaft, with all the gearing, pulleys and friction clutches were installed by Miller Bros. & Toms, Montreal, Canada.

The electrical equipment consists of three 180-kw three-phase Canadian General Electric generators, "star" connected, each machine having 12 poles, running at 600 revs. per minute and delivering current to the line at a pressure of 2500 volts and at a frequency of 60 cycles per second; two 6-kw standard bipolar Edison exciters, each belt-connected to a generator, and each capable of fully exciting the fields of the three generators; and a 4-pole, 5-kw Crompton exciter of the upright type, belt-connected to one of the generators and running at 1220 revs. per minute. The 18-inch oak tanned belt connecting each generator to its pulley on the jack-shaft below is guarded by a substantial iron railing. All the electrical apparatus, including the switchboard, but with the exception of the last mentioned exciter, was manufactured and installed by the Canadian General Electric Co., of Peterboro, Ont.

The switchboard, as may be seen from Fig. 1, is a four-panel skeleton hardwood board. The first panel is the exciter, the second and third are the generator panels, while the fourth and last is the line panel. The exciter panel contains the synchronizing apparatus, consisting of three step-down station transformers and the phasing lamps, coupling being performed when the lamps are bright, all on front of the board, besides the regulating apparatus for the three exciters. This consists of two ammeters, one voltmeter connected to any exciter by a switch, and two rows of switches for connecting any exciter to any generator field. Of these two rows the top line is made up of three double-pole double-throw switches to connect any of the three exciters, their terminals being connected to the middle pole, to either of two generator fields. The lower row contains three double-pole single-throw switches for exciting the remaining generator field from either of the three exciters. At the extreme bottom of the board are situated the three exciter rheostats.

The two middle panels contain the apparatus for the three three-phase machines. Nine duplex fuses are placed on the top of the board in front, connected in each of the three machine leads in such a manner that should one fuse blow, the other may be thrown in immediately by closing a single-pole switch placed below. Between the fuse blocks and the fuse switches are 9 ammeters, one for each machine lead; then a row of six switches, alternately the generator field and the main switches, the former being double-pole and the latter triple-pole for the three phases. At the bottom of the board are the three enamel field rheostats. The last or line panel contains three duplex fuse blocks with the three accompanying single-pole switches, serving the same purpose as those on the machine panels already explained; three ammeters, one for each line, and finally the ground detector, of the ordinary lamp type, and six lightning arresters, only three of which are in use, these being the Wurts non-arcing type and having 6 gaps between each line and ground.

No choke coils are used whatever. From the last panel the wires pass directly to the line at a pressure of 2500 volts, no step-up transformers being used. Directly in front of the switchboard are two rows of regulating wheels, as may be seen in Fig. 1, the front row containing four, for purposes of regulating the quantity of water entering each wheel by suitably adjusting the guide blades. The back row consists of only three, each regulating the friction clutch on the jack-shaft for driving its generator.

It was found necessary to install a steam auxiliary plant to secure uninterrupted operation, on account of the scarcity of water in dry summers, and also on account of the frazil ice difficulty. This steam equipment consists of two 250-hp simple Corliss condensing engines of the Jerome Wheelock type, running at 86 revs. per minute; two 250-hp water-tube boilers, both engines and boilers being manufactured and installed by the Goldie & McCulloch Co., Ltd., of Galt, Ont.; one 5¼x3½x6 inches feed pump for the boilers, water being taken from the head race, built by the Northey Manufacturing Co., Ltd., of Toronto, Ont., and a T. J. C. injector, used as an auxiliary feed. The boilers are situated in a brick building adjoining the upper end of the power house. Each engine is belt-connected to a loose pulley on the jack-shaft which, by means of a Hill friction clutch, transmits the power to the jack-shaft. All slack in the belt is taken up by a belt tightener situated on the power house floor at the point where the belt passes through to the jack-shaft below. Two 5-ton hand cranes are placed over the power house for handling and shifting machinery.

The three transmission wires coming from the power house pass

FIG. 4.—POLE LINE.

to the pole line, which follows the highway into St. Hyacinthe, a distance of five miles. A view of the line is shown in Fig. 4. The voltage is 2500 direct from the generators, no transformers being used at either end except for the secondary distribution in the city. The wires are No. 00 medium drawn bare copper, securely fastened to the ordinary double petticoat glass insulators and all placed on one cross arm, 18 inches apart. The poles are of white cedar, 40 feet long, 6 inches in diameter at the top, and are spaced 100 feet apart.

For protection against lightning a barbed wire is fastened with ordinary staples to the top of the poles and is grounded every fourth pole. In addition, lightning arresters of the Wurts outdoor

type are placed at three points on the transmission line and also at two points in the city, each having an insulated wire running to ground on glass insulators. A telephone line connecting the power house and the company's office is placed on the same poles, but a distance of 7 feet below the transmission line. It is also frequently transposed to neutralize induction.

On the principal streets, four-wire secondary mains are run from banks of single-phase transformers, reducing the primary voltage to 104. Power and light are both taken from the same circuits, but the drop due to the inductive load is not great, as the motors, although of the induction type, are neither large nor numerous The largest is a 50-hp Oerlikon three-phase induction motor supplying power to a boot and shoe factory. The drop of voltage in the line, due to starting this motor, is too great to pass unheeded, so that a signal, by means of a magneto bell, is sent to the power house when the motor is to be started and the machine voltage is regulated accordingly.

Current for light is sold by meter, the rate being 10 cents per kw hour. There are still a few flat rate customers, but they are gradually coming to use meters. Power is sold both by meter and by the flat rate, the charge in each case being according to the amount required.

The author desires to thank Mr. A. M. Morin, general manager of the St. Hyacinthe Hydraulic Power Co., and Mr. Geo. Pominville, electrician, for assistance rendered in connection with the preparation of this article.

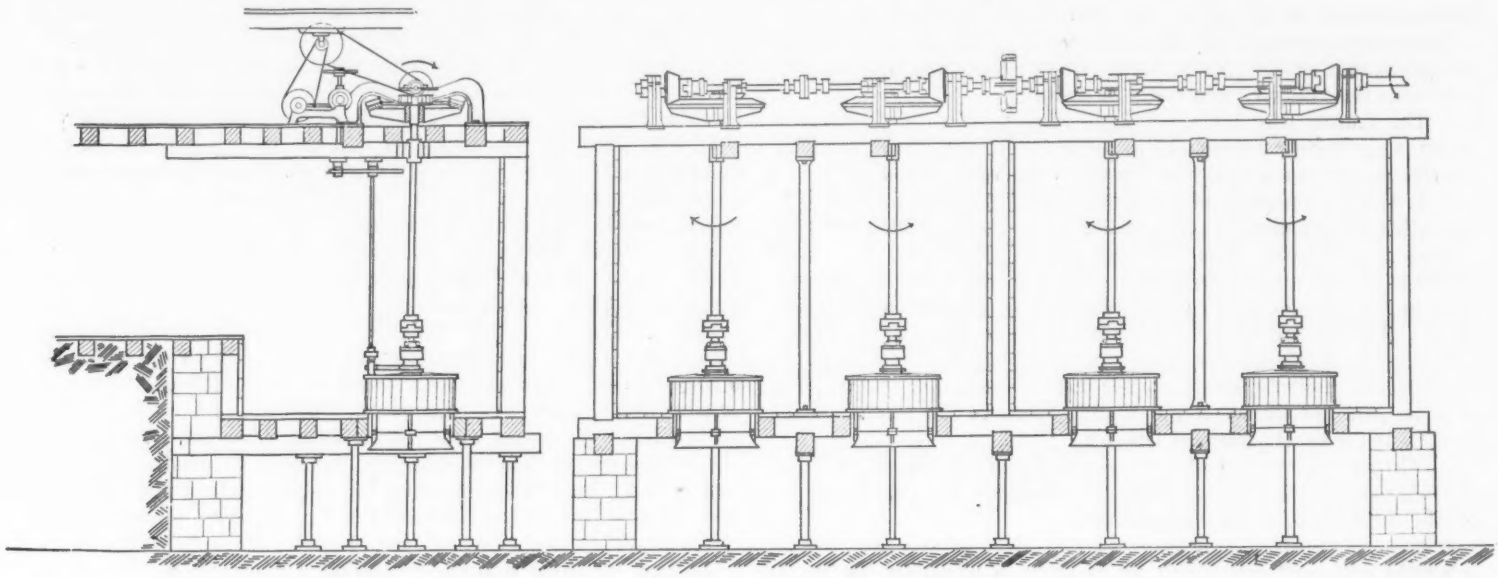


FIG. 5.—ELEVATION OF WATERWHEELS.

A New Primary Battery.

At the last regular monthly meeting held by the Franklin Institute, Philadelphia, Pa., Mr. J. D. Darling read a paper, entitled "A New Primary Battery," consisting of a description of the Harrison cell. This is an open-circuit primary battery, having a positive element of amalgamated zinc and a negative element of hard lead, surrounded by a mass of specially prepared lead peroxide. The electrolyte is dilute sulphuric acid, one part acid to six parts of water. The e. m. f. of the cell is from 2.4 to 2.5 volts, the average being 2.45 volts. The internal resistance averages .15 ohm, and on short circuit the current is about 16 amperes. The negative element is in the form of a round stick about 4 inches long by 1⅛ inches in diameter, and is made by compressing in a special machine a mass of lead peroxide around a simple conductor of hard lead that has previously been treated in a way that prevents sulphating. The zinc element is cast in the form of a cup, the electrode being imbedded in the interior. Within the cup and around the copper wire enough melted zinc amalgam is poured to completely fill it. This amalgam when cold is perfectly solid and no free mercury is visible; yet the mercury in the amalgam is stated to be almost instantly available when it comes in contact with the exciting fluid. When the zinc is placed in the dilute acid, the first action takes place on the surface of the amalgam; the zinc of the amalgam is dissolved and a minute quantity of the mercury is liberated which, in a very short time, spreads itself over the surface of the element.

Experiments With Wireless or Space Telegraphy.

BY DR. I. KITSEE.

IF one terminal of a telephonic receiver is connected to an aerial conductor terminating or ending in a plate or globe, and the other terminal connected to a plate or other conductor in contact with the earth or water, the diaphragm will vibrate if electric waves are in proximity to the aerial conductor.

To find out the reasons of these vibrations, and the arrangemet necessary to cause them, I made a series of experiments which I shall designate by the letters *A*, *B*, *C*, etc. The first test, which I call test *A*, was made with the following arrangement:

Test A.—A one and a half inch spark coil supplied by two secondary cells, had one end connected to the ground, and the other to an upright provided on its upper part with a metallic plate about six inches in diameter. The coil was placed on a stand about three feet from the ground. The plate was elevated from the ground about eight feet. About twenty feet from the coil was placed a second upright with its metallic plate connected, with the interposition of a telephonic receiver, to the ground. As soon as the key was closed and currents were induced in the secondary, the diaphragm vibrated; and if the receiver was held close to the ear, the vibrations could be distinguished.

Test B.—When the metallic diaphragm was replaced by a hard rubber diaphragm of about four times the thickness of the former, the vibrations followed as in test *A*.

Test C.—With a diaphragm of thin mica, vibrations were not distinguishable.

Test D.—With two mica pieces cemented together, vibrations were distinguishable.

Test E.—A second metallic diaphragm was used, separated from the first by a rubber gasket one-eighth of an inch in width and about one-thirty-second of an inch in thickness. With these two diaphragms the result proved far better than when only one diaphragm was used. The same result was obtained with one rubber and one metal diaphragm.

To ascertain if the electromagnetic coil plays any part in the effect, I continued the experiments as follows:

Test F.—The coil was removed from the core and the two terminals of the leading-in wires left open; tests *A*, *B*, *C*, *D* and *E* were then repeated with exactly the same result as when the coil was present.

Test G.—The terminals of the leading-in wires were then closed together and placed in electrical contact with the soft iron core on top of the permanent magnet, with a result similar to that of the former experiments.

Test H.—When the terminals of the leading-in wires were bent so

as to reach only part way up the tube, the vibrations were less distinguishable than in the former experiment.

Test I.—The magnet was taken out of the receiver and the terminals of the leading-in wires placed near the diaphragm, with a result that was less gratifying than with the magnet in.

Test J.—When the magnet, formerly in the receiver, was placed in proximity to the outer surface of the diaphragm, the result was similar to that of test *G*.

Test K.—The coil was replaced, the leading-in wires reconnected to the same, and the coil provided with a soft iron core, but with no magnet presented to the diaphragm. The vibrations were less than in test *J*.

Test L.—All parts were replaced and arranged as in test *A*, but with the rubber shell pierced on two sides, when hardly any vibrations were perceptible.

Test M.—A sound shell, with the permanent magnet as well as the electromagnet taken out, was provided with two metallic diaphragms separated from each other by a soft rubber gasket; one terminal of the leading-in wires connected to the lower and the other terminal to the upper gasket. Vibrations were distinguishable and nearly as well as in any of the other experiments.

These experiments were repeated with the addition of other experiments in the same line. From the whole series of those experiments the following can safely be deduced.

1. The reason why the diaphragm vibrates in a telephonic receiver is because the enclosed air in the receiver becomes agitated by the electric waves received with the aid of the leading-in wires.

2. It is not necessary that the diaphragm be of conducting material, but it is necessary that it shall offer a certain resistance to the molecules of the air. It is not necessary to provide the inner part of the shell with an electromagnet, which, in fact, does not play any part in the vibrations, but it is advantageous to place in proximity to the diaphragm if same is of soft iron or steel, a permanent magnet, for the reason that the normal tension and therefore sensitiveness of the diaphragm is greater in the presence of this magnet.

3. It does not matter if the leading-in wires are connected together or the inner terminals left free.

4. The air in the shell of the receiver should be closely confined and all parts of the receiver made air-tight, and, with the exception of the diaphragm, of a rigid material.

The parts necessary, therefore, in a receiver of this kind are an air-tight enclosure containing air or gases, a vibrating diaphragm being part of the enclosure; and leading-in wires, the terminals of which are in proximity to the vibrating diaphragm.

The law to be deduced from these facts can be expressed as follows:

1. The air in proximity to conductors conveying electric waves of high frequency acquires a pulsating or oscillatory motion.

2. The air contained in a rigid and air-tight receptacle provided with conductors conveying electric waves of high frequency, will transmit its motion to a vibrating diaphragm mounted as part of the receptacle.

To find out the necessary relations and connections between the vibrating receiver and the source of current waves, I made a new series of tests an account of the most important of which follow, designated by the letters *N*, *O*, *P*, etc. The tests were conducted in three adjoining rooms, each about fifteen feet long, with doors leading from one into the other; the rooms will be designated by the numbers 1, 2, 3, in the order they join each other.

Test N.—The coil was placed on a stand about three feet from the ground near the extreme end of room No. 1. One terminal of the coil was connected to the upright terminating in a six-inch plate about eight feet from the ground, and the other terminal connected to the spigot of a waterstand, the doors between room No. 1 and 2 being open. The vibrations of the receiver in room 2, when one terminal was connected to the water pipe, were clear and distinguishable.

Test O.—The coil as above, one terminal of the receiver connected through a flexible cord with the spigot of the water pipe in room No. 3, the other terminal connected with a flexible cord suspended from the top of the door in such manner that part reached into room No. 2, and part into room No. 3, the door between rooms 2 and 3 closed as far as the cord would permit. The vibrations were distinct.

Test P.—Same arrangement as in test *O*, but with the cord on the door disconnected from receiver. Vibrations were not distinguishable.

Test Q.—Same arrangement as in test *P*, but with the free terminal of the receiver touched by the same hand which grasped the cord hanging from the door. The vibrations very distinct.

Test R.—Same arrangement as in test *Q*, but with the hand touching the free terminal of the receiver out of contact with cord. Same result as in test *Q*.

The cord was then removed from the door and the door tightly closed so that no air vibrations could pass from room 2 to room 3, and the tests continued. To break all metallic connection between the coil and the receiving instrument, the connection of one terminal of the coil was changed from the water spout to a gas jet in room 1 and the tests continued.

Test S.—One terminal of the receiver was connected to the water spigot, and the other terminal left free, when no vibrations were distinguishable.

Test T.—One terminal of receiver was connected to the water spigot, and the other terminal touched by a finger of the hand holding the receiver. The vibrations were clear and distinguishable.

Test U.—Same as test *T*, except that a second person was placed between the receiver and spout in such manner that one hand touched the spout and other hand one terminal of the receiver. If the person holding the receiver touched the second terminal with his finger, the vibrations were very distinct, but as soon as he removed his finger from the terminal, the vibrations ceased.

To determine if it was necessary that the person holding the receiver should himself touch one terminal, the following experiment was made:

Test V.—One terminal of the receiver was connected to the water spigot, and the second person touched the free terminal; the vibrations were clear and distinguishable, and as soon as the finger was removed, the vibrations ceased.

Test W.—The connection with the water pipe was removed. The person holding the receiver stood on carpet, which by the way, was a Smyrna rug; a second person stood on the bare floor. The person holding the receiver touched one terminal with no result; the person holding receiver removed his finger from the terminal and the second person touched one terminal with no result. The person holding the receiver standing on carpet touched one terminal, and a second person standing on the floor touched other terminal when vibrations were distinguishable—but were very weak.

To find out if the upright connection was necessary, the experiments were continued with the following results:

Test X.—The terminal of the coil in the first room was disconnected from the upright, and provided with a soft rubber hood, so as to be inclosed entirely in the rubber covering. The above tests with the receiver were then repeated, and the result was invariably the same as with the upright in the circuit.

To determine if particular parts of the body have to be in contact with one terminal of the receiver, I continued the experiments as follows:

Test Y.—One terminal of the coil in the first room was connected to ground, first through water pipe and then through gas pipe, the other terminal of coil being left unconnected and covered with the rubber hood, and with the door leading from the second to the third room locked; one terminal of the receiver was connected to the water spigot in room 3 and other terminal was in contact with the finger through a short wire; the finger removed from the wire and the terminal brought into contact in succession with different parts of the body. As long as the wire touched the body itself, the vibrations were clear and distinguishable, but when touching the clothes all sound ceased.

To ascertain if the ground connection is a positive necessity, I continued tests as follows:

Test Z.—The ground was disconnected from one terminal of the coil, and the other terminal connected with the upright; one terminal of the receiver was left free and the other placed in contact with the finger of the person holding the receiver. The vibrations were distinguishable, but not as clear and distinct as with the ground connection as long as the door between the second and third room was left open; but as soon as the door was tightly closed no sound was distinguishable.

On one of the experimental days it chanced to rain and the atmosphere was therefore filled with moisture. At that time the last enumerated test was repeated with far better result than in the former test, during which the atmosphere was comparatively dry.

From all these experiments I deduce the following:

1. It is necessary that a receiver for electric waves of high intensity should be exposed to or in contact with a medium capable of being polarized through impact with electric waves.

2. The air as well as the ground can be used as such medium.

3. It is necessary to bring the different terminals of the receiver in contact with media at different potentials.

To adapt the results of these experiments for practical purposes, the following arrangements can be used:

1. Two ear receivers with an adjustable band so as to be worn around the head, are provided with two flexible wires, one leading each from one terminal of the receiver, the receivers themselves being connected in multiple to each other. One wire terminates in a metallic plate fastened to the sole or heel of the footgear of the person using the receiver, and the other terminal of the wire is left bare and brought in contact with the ear or other part of the body of the person using the receiver.

Equipped with this instrument, one may patrol the shore, and will be made aware if any one of nearby stations wants to communicate with him—for instance, a vessel not far distant desiring to send a message, or a light-house wishing to attract his attention. Or a railroad employee, a so-called track-walker, can with this device, by bringing the plate on his foot in contact with the rail, ascertain if the person in charge of an approaching train, or one from the distant station, wants to communicate with him.

This arrangement may also be used on moving trains. The rails are divided into sections, and the engineer, or conductor, or other person in charge of the train, is provided with a receiving instrument. As soon as the train approaches a section, the engineer finds out through the receiver if the section is clear, and if such be the case, he proceeds; at the same time he brings his sending instrument into action by connecting one terminal of the same through the wheels with the rail, the other terminal being left free or covered with a non-conducting substance.

The person in charge of a second approaching train, if equipped with the receiving instrument will, as he approaches this section, at once ascertain that a train is ahead of him, and he will, therefore, either slack up or wait till the section is clear. It is necessary that the floor of the compartment in which the receiving instrument is stationed should be conducting and in electrical connection with the rails.

This arrangement will, it is believed, effectually prevent collisions on steam roads.

A Self-Correcting Photometer Scale.

BY BUCKNER SPEED.

In an incandescent lamp photometer in which the lamp under test is balanced against a standardized lamp, it is usually necessary to multiply the candle-power as read on the "direct reading" photometer scale, by the candle-power of the standard lamp, as the standard lamp is rarely 16-cp, but usually a fractional value as 15.5, 16.4, etc.

The slide rule scale shown in the cut has been applied to a standard lamp photometer by the writer and by means of it the candle powers of the lamps being run through test, can be read off directly without any corrections, and with great rapidity.

The pointer at *B* in the cut is fastened to the screen carriage and moves along an ordinary "direct reading" photometer scale, graduated so that when the pointer is half way between the lights the scale division would be 16-cp. No numbers are put on this scale, however, but the division points are carried by slightly oblique lines down to a readjustment of their spacing which changes them into the points of a logarithmic scale.

Immediately below the bottom of the oblique lines is a similar logarithmic scale ruled on the upper and lower edges of a slide, while below the lower scale is a fixed pointer, *A*, which is fixed directly below the position of the pointer *B*, when it is at the position half way between the lights.

To set the scale for direct reading of the corrected candle-power, the slider is moved along until the pointer, *A*, is pointing the candle-power of the standard lamp. In the cut this is supposed to be 15.50-cp. This position of the slide is not changed unless another standard lamp with a different candle-power is used.

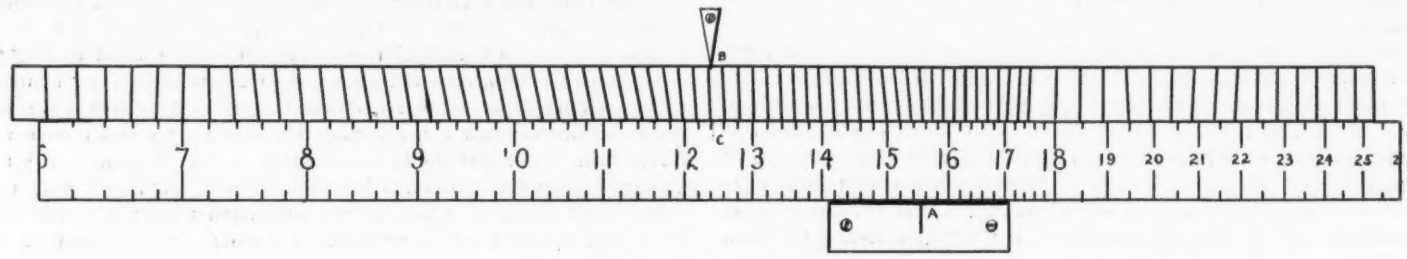
The screen carriage is now set as in the ordinary way, and the position of its pointer *C* is carried down by means of the oblique lines and the corrected candle-power read at *C*, which in this case is shown at 12.22-cp. The scales shown are 15.175 inches long and are correct for a photometer bar, having a distance of 84 inches between the lights. In applying the scale to an 84-inch bar, the pointer, *A*, is set and fixed exactly half way between the lights, and the sliding scale set with 16 at the pointer *A*. The top scale is then adjusted so that its lower edge corresponds exactly with the rubber edge of the slide.

The positions given in the tables are calculated for the even numbers, the intermedial two-tenth divisions being interpolated. The values in the photometer scale column are found to be evaluating in the expression.

$$l = \frac{1}{\frac{\sqrt{r}}{d} + \frac{1}{a}} - 31{,}900,$$

in which l is value in column 2 of the table—that is, distances of the even divisions from division 6; r is the ratio of the intensities of the lights, and d the distance between the lights or 84 inches; 31,900 is the distance in inches from the lamp under test to division 6.

The logarithmic scale is obtained by multiplying the tabular logarithmic from 6 to 26 by 23.83 and subtracting from each the log of 6.



LOGARITHMIC PHOTOMETER CURVE.

TABLE FOR PHOTOMETER HAVING 84 INCHES BETWEEN LIGHTS.

Even division numbers.	Distances of even divisions of top scale from the beginning p int 6 (photometric scale) inches.	Distances of even divisions of sliding scale from the beginning point 6 (logarithmic scale) inches.	Even division numbers.	Distances of even divisions of top scale from the beginning point 6 (photometric scale) inches.	Distances of even divisions of sliding scale from the beginning point 6 (logarithmic scale) inches.
6	0,000	0,000	17	10,740	10,790
7	1,580	1,600	18	11,340	11,370
8	2.900	2,980	19	11,900	11,940
9	4.110	4, 00	20	12,445	12.470
10	5,190	5.290	21	12,955	12,970
11	6,180	6.2.0	22	13.410	13.450
12	7,090	7,180	23	13.900	13.910
13	7,930	7.9·0	24	14,345	14.350
14	8,700	8,770	25	14, 60	14,7·0
15	9.430	9.490	26	15,175	15,180
16	10,100	10,160			

American Export Trade.

The exports of wheat and cotton are running heavier this year than last, and up to the present time are $10,000 ahead of last year. The ten months to April, 1899, show exports of manufactures of $275,978,300, against $234,737,000; while agricultural have fallen off to just the extent of the difference, owing to the decline in produce prices. Manufactures of copper show an increase in the ten months of $4,500,000, and instruments and scientific apparatus increased 50 per cent., the total amount being $3,500,000. Exports of iron exhibit an increase for the ten months of $54,000,000, of which steel has increased to $76,251,736, against $56,000,000, of which $20,000,000 is in sugar.

Early Researches in Wireless Telegraphy.

In a recent number of London *Electrical Review*, Prof. J. Monroe gives his recollections of the experiments of Prof. Hughes in 1877-79, which are mainly confirmations of the statements made in a letter of the latter. Prof. Monroe says that not only did Prof. Hughes send and receive signals through space all over his house, and from the third story to the basement of a factory in the neighborhood, but he would leave his transmitter working at home and carry a receiver 500 yards up and down the abutting street and distinctly hear the clicking of the transmitter. He found that he could not hear so well when his body was interposed between the transmitter and receiver, but when the body of another person was thus interposed there was no diminution in the sound.

Prof. D. E. Hughes in a recent letter to Mr. J. J. Fahie, gave an account of some experiments which he made on aerial telegraphy, dating from 1879 to 1886. While experimenting in 1879 with the Hughes induction balance, he remarked that at times he could not get a perfect balance through apparent want of insulation in the coils, but investigation showed that the real cause was a loose contact or microphonic joint in some portion of the circuit. When the microphone was applied under these conditions, it gave a sound in the telephone receiver no matter if the microphone was placed directly in the circuit or placed several feet distant from the coils through which an intermittent current was passing.

Further researches proved that an interrupted current in another coil through which an electric current was passing, gave out at each interruption of the primary current such intense extra currents that the whole atmosphere in the room and even in distant rooms would be subjected to a momentary invisible change, which became evident if the microphone joint was used as a receiver to a telephone. This led Prof. Hughes to experiment as to the best form of receiver for the invisible electric waves, which evidently permeated great distances and through apparent obstacles such as walls, etc. He found that all microphonic contacts or joints were extremely sensitive. Those formed of a hard carbon, such as coke, or a combination of a piece of coke resting upon a bright steel contact, were very sensitive and self-restoring; whilst a loose contact between metals was equally sensitive, but would cohere or remain in full contact after the passage of an electric wave.

Prof. Hughes says that the sensitiveness of these microphonic contacts in metals, since rediscovered by Branly and Lodge, has been misnamed by the term coherer as applied to the organ of reception. The most sensitive and perfect receiver that he has yet made does not cohere permanently, but recovers its original state instantly and therefore requires no tapping or mechanical aid in the separation of the contacts after being momentarily brought into close union. Prof. Hughes found that whilst an invisible spark will produce a thermo-electric current in the microphonic contacts (sufficient to be heard in the telephone in its circuit), it is far better and more powerful to use a feeble voltaic cell in the receiving circuit, the microphonic joint then acting as a relay by increasing or diminishing the resistance of the contact, through the atmosphere.

In 1879 whilst making these experiments on aerial transmission, Prof. Hughes said he had two different problems to solve: First, what was the true nature of these aerial waves, which seemed, whilst not visible, to spurn all idea of insulation, and permeate all space to a distance undetermined. Second, to discover the best receiver that could act upon a telephone or telegraph instrument so as to be able to utilize (when required) these waves for the transmission of messages. The second problem was easily solved, when it was found that the microphone had the power of rendering the invisible waves evident, either in the telephone or galvanometer, and up to the present time he does not know of anything approaching the sensitiveness of the microphonic joint as a receiver. He states that Branly's tube, now used by Marconi, was described by him in a paper read before the Royal Society May 8, 1878, as a microphone tube filled with loose filings of zinc and silver. He adds that Prof. Lodge's coherer is an ordinary steel microphone, but used for a different purpose from that in which Prof. Hughes described it.

In 1879, Mr. Preece, Sir William Crookes, Sir W. Robert Austin, Prof. W. G. Adams and Mr. W. Groves witnessed his experiments upon aerial transmission, which were repeated February 20, 1880, before Mr. Spottiswood, Prof. Huxley and Sir George G. Stokes, and on Nov. 7, 1888, before Prof. Dewar and Mr. Lenox. The experiments were by means of an extra current produced from a small coil and received upon a semi-metallic microphone, the results being heard upon a telephone in connection with a receiving microphone. The transmitter and receiver were in different rooms about 60 feet apart; after trying successfully all distances allowed in his residence in Portland Street, his usual method was to put the transmitter into operation and walk up and down Great Portland Street with the receiver in his hand and the telephone to the ear. The sounds seemed to slightly increase for a distance of 60 yards, then gradually diminish until at 500 yards he could no longer hear with certainty the transmitted signals. What struck him as remarkable was that opposite to certain houses he could hear better, whilst at others the signals could hardly be perceived. Prof. Hughes adds that Hertz' discovery of nodal points in reflected waves, 1887-9, has explained to him what was then considered a mystery.

Mr. Spottiswood, President of the Royal Society, together with Prof. Huxley and Prof. Stokes, called upon Prof. Hughes, Feb. 20, 1880, to see his experiments upon aerial transmission of signals. At the close of three hours' experiments, Prof. Stokes said that all the results could be explained by known electromagnetic induction effects and therefore he could not accept Prof. Hughes' view of actual aerial electric waves unknown up to that time. He thought, however, there was enough original matter to form a paper on the subject to be read before the Royal Society, but Prof. Hughes says that he was so discouraged at being unable to prove the existence of these aerial waves that he would not write a paper on the subject and continued his experiments for some years in the hope of arriving at a perfect scientific demonstration of the existence of aerial electric waves produced by a spark from the extra currents in coils or from frictional electricity or secondary coils. The triumphant demonstration of these waves, he says, was reserved for Prof. Hertz, who by his masterful researches upon the subject in 1887-9, completely demonstrated not only their existence but their identity with ordinary light. He adds that Hertz' experiments were far more conclusive than his, although he used a far less effective receiver than the microphone or coherer. Prof. Hughes draws attention to some experiments of Prof. Henry, who, at a date unknown, but probably about 1850, magnetized a needle in the coil at 30 feet distance and magnetized a needle by a discharge of lightning at eight miles distance.

Prof. Hughes pays a tribute to Marconi, who, he says, by the use of Hertzian waves and the Branly coherer has been able to transmit and receive aerial electric waves through greater distances than had previously been dreamed by the numerous discoverers and inventors who have worked silently in that field. His efforts at demonstration merit the success he has received; and if he has discovered the means of concentrating these waves on the single point desired, without diminishing its power, Prof. Hughes believes the world will be right in placing his name on the highest pinnacle, in relation to aerial electric telegraphy.

Simultaneous Telegraphy and Telephony.

At the recent meeting in Wilmington, N. C., of the Association of Railway Telegraphy Superintendents, Mr. Charles Selden assigned priority to Prof. Van Rysselberghe, of Belgium, for the invention of simultaneous telephony and telegraphy. While it is true that Prof. Rosebrugh, of Canada, in 1879 had patented a system for the duplexing of telephones previous to the filing of the Van Rysselberghe patent in this country, he considers that to the latter belongs the credit for the invention of simultaneous telegraphy and telephony, for the reason that if his patent paper be read it will be found that its prime and only object was this purpose, while Prof. Rosebrugh in his patent seems to have had nothing in view except the duplexing of a telephone circuit so as to make one wire as good as two.

Mr. Thomas D. Lockwood read a paper at the same meeting in which the several systems of multiplex telephony and simultaneous telephony and telegraphy were described.

The Rosebrugh method for a single line conductor consists in the arrangement of grounded telegraph apparatus at the terminals of the line; the line is also tapped at each end, and a telephone and condenser are interposed between the top and ground. With two line conductors, a telephone in series with a condenser is bridged at each end of the line, and each conductor also used as part of a grounded telegraph circuit. In the second case the telephone circuit is all metallic.

In 1882, Frank Jacob patented a plan for the simultaneous transmission of two telephonic messages over the two wires of a metallic circuit. This consisted in using the closed loop of a metallic circuit for the telephone circuit and the two sides of the loop in parallel for a grounded telephone circuit. In the period extending from 1882 to 1885, Van Rysselberghe's plan of composite telephony and telegraphy made its appearance. The latter system went further than previous ones, making a really high class system of composite operation wherein three messages—one telephonic and two telegraphic—can be simultaneously sent over two wires.

In this system, the telephone at each end is in series with a condenser bridged across the two-line conductors, and each line conductor has, at its terminal, grounded telegraphic apparatus. An inductance coil in series with each telegraph instrument, and a grounded condenser in shunt with the two coils of the two lines, smooth the telegraphic impulses so that they will not affect the telephones. The bridged condenser in series with the telephone prevents the telegraph current from passing to ground, and the inductances perform the same service for the telephone currents.

Conti in 1883 suggested a method whereby a short telephone circuit may be engrafted, so to speak, on two telegraph lines between two way stations, but the principles of this method are to be found in the differential modification of Jacob's arrangement. Mr. John J. Carty has made such an adaptation, wherein the usual metallic circuit extends between two terminal stations, at each of which it is fitted with telephone instruments. The line may be divided into one, two or more sections by arranging at one or more pairs of stations, with retardations or impedance coils between the main conductors, and by connecting the centres of the two bridges of a pair by a return conductor or ground; the extra instruments—either telephone or telegraph instruments—being introduced into the way circuit thus formed, at the ends.

Transformer Tests.*

In a paper with the above title Prof. W. E. Goldsborough gave an account of a series of tests on transformers conducted in the electrical laboratories of Purdue University. Five different transformers were received from manufacturers and the paper gives an account in detail of the tests on these. In making the initial tests the transformers were kept under full load and at 1000 volts primary pressure from 12:30 p. m. until 11 p. m. daily except on Saturday and Sunday when the run commenced at 6 p. m. and ended at 11 p. m. The transformers were thus under load 10.5 hours a day five days in a week, and were allowed to cool down to the temperature of the room in which they were located during the remaining 13.5 hours per day. On the other two days they were kept under constant full load for five hours and allowed to cool during the remaining 19 hours. The temperature of the room averaged 25 degrees C. throughout the test, not varying more than a few degrees on either side of that value. The highest actual temperature attained by the core iron in any one of the transformers did not exceed 75 degrees C., and the average maximum temperature of the cores at the end of a ten hours' duration was not over 60 degrees C. Assuming that general service conditions are represented by a daily working schedule of one-half load for four hours per day and full load for two hours, the transformers were subjected to a much harder service than they would naturally receive in fifteen months, and to a service that is never likely to be equaled by any transformer in actual service, if a comparison is made on the basis of the maximum temperatures attained. The high-voltage insulation tests or breakdown tests were made at the end of the ageing tests at voltages prescribed by the several manufacturers in the specifications submitted with the transformers.

A series of tests was also made to determine the dielectric strength of the oils used to insulate the three oil-insulated transformers tested. The samples of oil were drawn off when the transformers were first connected and at intervals of about 300 full-load working hours thereafter. The tests were made with step-up transformers, the source of power being a 7½-kw smooth-core alternator having a frequency of 125 and developing a practically pure sine wave of e. m. f. The order of the test was to gradually increase the voltage from 2500 until the breakdown occurred.

The paper describes in detail the various transformers submitted to test and discusses in each case the conditions of the test, any peculiarities noted, etc. The accompanying tables give a synopsis of the results. As will be noted, none of the transformers tested showed any evidences of ageing. The showing, as to regulation, copper and iron losses, are also generally favorable.

In the discussion Mr. Leslie gave his experience covering a number of years with transformers. The specifications of his company required a 2 per cent. regulation with a 2 per cent. core loss and an insulation resistance between the coils of not less than 2000 megohms. The matter of ageing came up quite early, and the tests of Prof. Goldsborough show that manufacturers have recognized its serious bearing and have been working to overcome the defect. Mr. Leslie considers that the use of oil in indoor transformers is objectionable, and he doubts whether the insurance companies will permit it to be used. His experience was that the life of a transformer did not extend much beyond five years and this holds good even of the transformers of to-day.

Prof. Goldsborough agreed that the life of transformers as they were built five years ago would not exceed five years, but he said that since transformers as now made will stand a heavy insulation test and the iron did not seem to age, he should say that the life of the transformer made at this time was commensurable with the life of other electrical apparatus. Mr. Leslie rejoined that the transformers to which he referred were made under specifications that will stand to-day, and that he believed five, six and at the most seven years was the normal life of present transformers.

Prof. Robb considered that the data given by Prof. Goldsborough should be considered to apply only to transformers used for lighting service. Transformers can be roughly divided into three classes: For lighting, when the full load is on only for two or three hours; for running induction motors for power service where for about half a minute after the time of starting they are overloaded perhaps 100 per cent., and where they run on practically a full load on a 10-hour run; third, step-up and step-down transformers in central stations, or a static transformer used in running rotary transformers where it is subjected to a load of 80 per cent. full load twenty hours a day 365 days a year. The transformers tested by Prof. Goldsborough would in some of the above cases reach a temperature of 94 degrees C. and under these conditions the test of the transformer would have showed an ageing of 50 per cent. It is necessary that transformers running at full load continuously have a much lower temperature. In reply to a question, Prof. Goldsborough said that practically the ageing of transformers results entirely from the heat and there is no magnetic ageing.

TESTS FOR REGULATION, LOSSES AND EFFICIENCY, 60 CYCLES.

Transformer.	Capacity. K. W.	Sec Voltage.	Regulation, Hot. Per cent.	Losses, Full Load, Hot.				Efficiency Loads.						Rise in Temperature, 10 hours. Degs. C.
				Copper.		Iron.								
				Per cent	Watts.	Per cent	Watts.	.1	.25	.5	.75	1.00	1.25	
1	5	110	1.74	1.78	92.	1 63	84 3	85.4	93.3	96.0	96.5	96.6	96 5	24.9
2	5	104	2.63	2 51	131.7	1.41	73.6	87.	93.9	95.9	96.2	96.1	95.7	27.1
3	5	110	2.16	2.07	108.0	1 76	92.6	84.2	92.7	95.4	96.1	96.2	96.	52.1
4	5	100	2.32	2.05	106.	1 42	71.2	87.4	94.1	96.2	96.6	96.6	96.4	30.6
5	5	100	2.12	2 04	106.	1.71	88.9	84.7	92 9	95.6	96.2	96.3	96.2	49.9

AGEING TESTS.

Hours, full load.	Core Loss, Watts.				
	1	2	3	4	5
0	85.	73 8	95.	71.8	90.5
114.8	85.	73.9	93.	71.	....
163.4	85.	72.2	93.	71.8	....
186.7	84.2	73.5	92.5	71.	....
220.7	83.9	73.5	91.2	71.	89.
265.7	85 5	74.	91.	70.7	....
349.7	83.	73.	91.	70.	90.
493.7	83.3	72.8	89	70.	....
601.7	83.2	73.3	91 3	70.5	91.
821.8	83.	73.8	91.	69.	....

Mr. Wagner gave an account of a test with four transformers of the same size, the same number of turns in a coil, but with a varying amount of iron. The current was kept on the primary coils of these transformers continuously for about three years, and there

*Abstract of paper read at the recent National Electric Light Convention.

was not enough difference in the ageing of the same to warrant any one in drawing any conclusions as to the effect of increasing the density. Not only did the iron in the different transformers run at different densities, but the higher the density in the iron the higher the temperature at which the transformers operated during that time, so that the test also tended to show that an increase of temperature had very little effect.

Electrical Notes in China—II.

BY PROF. F. B. CROCKER.

ELECTRIC lighting in China is in a more advanced condition than the telephone service, but is still very limited, only a few cities being supplied with it. The Shanghai Central Station contains several old Brush machines for series arc lighting at 3000 volts. The overhead lines for this service consist of very old "underwriters" wire with the insulation entirely worn off in many places. They have been in use for ten or fifteen years and are entirely unfit for such high voltage, but are to be replaced by something better in the near future. The incandescent lighting plant consisted of five Mordey alternators, having an aggregate capacity of 180-kw. A new plant was being put in, consisting of two Mordey alternators of 150-kw each, directly connected to the new vertical high speed (270 r. p. m.) engines built by the Brush Engineering Company of England. The construction and insulation of the lines for this alternating current service is new and much better than for arc lighting.

At Canton an old station of small capacity was in operation, but a new one with the best modern apparatus was being installed. The boilers, already in place, were three Babcock & Willcox of 200-hp each at 150 pounds steam pressure. Green economizers were also to be used. The plant, located on the river front, was to have three vertical, triple-expansion, condensing engines, directly connected to alternators. The station building, foundations, fittings, etc., are of the latest and best construction. So this installation, although of only moderate size (about 400-kw) is a very creditable one—almost unique, in fact, at the present time in China. This plant is situated in the Chinese city and, I was informed, is owned by a Chinese company. The electric lighting system at Shanghai is owned and operated by the English and American municipality. As already stated, foreign trade in China is confined to certain "open ports" designated by treaty. In these a certain amount of land called a "concession" is granted or sold to the foreign residents. The latter elect a muncipal council who carry on the affairs of the community very much as in an English or American town. There is a French "concession" in Shanghai separate from the combined English and American. The "Chinese city" is entirely distinct and governed by the Chinese themselves. Almost all foreigners, except missionaries, reside in the concessions and in most cases very rarely even enter the Chinese cities. But a great many Chinamen live and keep shops in the foreign concessions. The same arrangement has existed in the treaty ports of Japan since that country was opened to the world by Commodore Perry, but on July 15, 1899, the new treaties with other nations go into effect, and a foreigner in Japan has about the same status as he has in a European country. Foreigners and their concessions will then come under the control of the Japanese authorities and the consular courts will cease to exercise jurisdiction over them. Most of the foreign residents are opposed to the change, fearing they will not get full protection and justice from the Japanese, but it is to be hoped that their anxiety is unfounded in this important matter.

FIG. 2.—STREET SCENE, SHANGHAI.

It would not be safe to attempt a similar change in regard to foreigners and concessions in China, the Government being far too irresponsible. Apparently the problem will be solved by turning over the whole country in sections as foreign concessions to the various powers. That process is now going on at an alarming rate. Hongkong is a British colony (being rapidly extended, by the way) and is therefore not part of China; but the conditions there regarding electric lighting and other electrical matters are very much the same as in Shanghai.

Saigon is the capital of the French Indo-Chinese possessions, which are of enormous extent—far greater than most of us have any conception of. There I saw a fine central station building containing three Laval turbines of 150-hp each, with two Manchester type dynamos geared to each turbine, the generators having 50-kw capacity individually. These are the well-known combination manufactured by the Maison Breguet of Paris. The man in charge of the station said that they intended to add a 300-hp Corliss engine with Breguet dynamos. Incandescent and arc lamps are operated on the

three-wire system in various parts of the town, which is of considerable size, also very clean and attractive in appearance. There was no other electrical feature of special interest in that city, but the American Consul informed me that a number of electrical plants were being constructed or planned in that and other towns of the colony. The work of building as well as installing the apparatus is almost entirely in the hands of the French.

Underground Electrical Construction.*—I.

In the early 80's, among the first underground systems, there was developed by the Edison Company a two-wire system adapted for low-tension distribution at 110 volts. The system was made up of tubes, so-called, consisting of iron pipes in lengths of approximately 20 feet, in each of which were placed two copper conductors, having a cross section shaped like a half-moon, the conductors being separated from each other by an insulating medium of asphaltum.

The rapid growth of the lighting business rendered the use of the two-wire system for low-tension distribution purposes of limited value, and the advent of its successor, the three-wire system, brought forth the design of the three-wire Edison tube system, now so extensively used in all of the large cities of this country. This system was most carefully thought out in every detail by its designers and forms a complete network of underground conductors, all of its parts thoroughly interchangeable and capable of the greatest flexibility, both in construction and in operation. The conductors were made in much the same manner as the early Edison two-wire tube, except that three circular copper rods were employed in place of the two half-moon conductors. Each copper rod is sufficiently wound with a jute cord, so as to afford mechanical separation between the conductors themselves. The rods are then placed in an iron pipe and insulated from each other by asphaltum, the tubes being plugged at each end with hard rubber. The tubes are made in lengths of 20 feet 6 inches, and are laid in the ground, coupled together by means of flexible stranded copper couplings, enclosing which is placed an oval coupling box, and in which is poured asphaltum compound for insulating the joints and rods one from another and from the ground. Being laid in lengths of 20 feet, it affords a ready connection to each building, service boxes in the shape of a "T" being used wherever connections to the buildings are made from the main.

At each intersection these tubes enter a cylindrical cast-iron junction box, in which are placed three copper rings, to which are connected the three copper conductors of each main by means of fusible safety catches. These junction boxes are fed by feeders directly from the central station, the feeder tubes in the original system being of the same general type as the main tubes, the difference being that one of the conductors, which is used as a neutral in the feeder, has one-third the cross-section of each of the other conductors. In each of the feeder tubes is also placed three small pressure wires, which are connected to the rings of the junction boxes in which the feeder terminates, the station end of the pressure wires being connected to a voltmeter, which indicates the voltage at the feeder end in the junction boxes.

The mains are made in all sizes from 250,000 circ. mils to 500,000 circ. mils, and the feeders in sizes from 250,000 to 1,000,000 circ. mils. Special feeders have been built with one pole in each tube running as large as 3,000,000 circ. mils. The following table gives the cost of the tube, labor, fittings and paving in laying one length of main in various sizes from 100,000 circ. mils to 500,000 circ. mils, in streets with various pavements.

Labor, fittings and paving, laying one length main tube:

Sizes—	500	400	350	250	200	100
Unimproved, no paving....	6.71	6.71	6.71	6.08	5.66	5.45
Macadam	8.50	8.50	8.50	7.75	7.46	7.25
Cedar	10.17	10.17	10.17	9.43	9.02	8.11
Cedar reserved	13.61	13.64	13.61	12.89	12.59	12.38
Granite	12.48	12.48	12.48	11.74	11.44	11.23
Granite reserved	22.12	22.12	22.12	21.36	21.07	20.85
Asphalt	29.81	29.81	29.81	29.18	28.77	28.56
Cost of tube.....	34.73	30.26	28.28	15.88	18.36	9.68

In European countries the underground system of distribution, until recently, has almost universally employed cables laid directly in the ground, the cables being insulated either with paper or rubber, covered with lead, the lead covering being asphalted, served with jute and impregnated with asphaltum, the jute and asphaltum acting as a preservative to the lead. The methods of coupling cables and the installation of services are similar to those described for the Edison underground system, as used in this country, the copper couplings being adapted for the use of cables instead of rods. The experience of European central stations shows that very little trouble is encountered by the development of short circuits in cables, and the cost of repairs is exceedingly small.

It has been supposed by many that the cost of maintaining Edison tube systems for mains was excessive, and that troubles from short circuits and grounds were too frequent in this country, and some companies have been led to consider seriously the use of duct systems, employing cables for both feeders and mains in their distribution system. While the writer believes that the Edison tube is not desirable for feeders on account of the excessive loads which they are obliged to carry at the time of peak of the central station, and also in some cases for many hours in the day, it certainly is a fallacy that cables should be generally employed for mains in the place of Edison tube, as may be proven by reference to the actual cost of repairs and renewals on Edison tube mains. While it is undoubtedly true that in any system employing cables throughout, both for feeders and main, the probability of short circuits and grounds will be exceedingly slight, as compared with those employing Edison tubes, the additional cost of the interest on the investment in case a cable system is used for mains, as well as feeders, will more than offset the cost of repairs and renewals when Edison tube is used for mains and cable for feeders.

An analysis of the cost of repairs and renewals of the low-tension underground system of a large central station company, where approximately 90 per cent. of the low-tension underground investment is made up of strictly Edison tube installation, shows that the maintenance cost of mains and feeders represents an extremely small annual percentage of the value of the total investment; so small, in fact, that it readily explains why the company, even in laying new mains, is reluctant to abandon its original method.

A conservative estimate of the additional outlay required to install a cable conduit system over that of the Edison tube system for mains, but not including feeders, would be, in densely settled territories, from 33½ to 50 per cent. The total annual cost of supervision and maintenance of the low-tension underground system referred to is 1.9 per cent. per annum of such total underground investment, the division of the costs being as follows:

	Per Cent. of Entire Investment.
Office	.093
Distribution	.140
Junction box and testing feeder mains	.092
Cleaning and filling manholes	.075
Repairs on trunk line	.109
Purchase of tools and repairing	.121
Repairing of mains	.180
Repairing of feeders	.332
Repairing of service	.085
Repairing of junction boxes	.056
Routine operating	.056
Repair to manholes and conduit	.222
Miscellaneous expense	.019
Paving inspection	.026
Watching company's lines	.060
Paving	.182
Labor for renewing mains	.075
	1.91%

It will be seen by carefully considering these accounts that some are incident to the conduit system, which has been installed to some extent during the past few years. The paving charges could safely be distributed between feeders, mains, service and junction boxes in the proportion of their various expenses, and the inspection charge could also be distributed in a similar manner. The percentage charge for labor for renewing mains represents that expended in replacing with larger mains those which have become too small to safely carry the business connected, and the cost of the material for the new main may be charged against investment, the value of the old mains being credited to investment, which is a proper and conservative method.

If we take, in the list of costs above stated, the items for trunk lines, feeders, mains, services, junction boxes, one-half the tools, one-half the routine operating, one-half the miscellaneous, two-thirds of the watching of lines and the renewals of mains as representing the true charges against the cost of maintenance of a purely Edison tube system, we find that the annual maintenance charge is 1.27 per cent. Assuming, then, that all of these items, amounting to 1.27 per cent., would be eliminated from the maintenance cost in case a cable system were used, we would then have a maintenance charge for the cable and conduit system of .64 per cent. per annum. To this must be added the interest charge at 5 per cent. on the 33½ per cent. additional investment required for a cable and conduit system.

*Abstract of a paper read by Mr. L. A. Ferguson at the recent convention of the National Electric Light Association.

which would amount to 1.66 per cent. per annum, making a total annual maintenance charge of 2.3 per cent. for the cable and conduit system.

Notwithstanding the greater increase in the original investment most of the large central station companies have abandoned the use of Edison tube for feeders, and are now employing cables drawn into ducts on account of the additional ampere capacity per 1000 circ. mils gained thereby, and the advantage of quick repairs, reliability of service, minimizing of trouble from short circuits, due to grounds overloading and moisture, together with the additional permanency which is gained by the use of cable and conduit system. With the same section of copper it is possible to carry on a cable feeder, without permanent injury, a larger load than may be carried in a tube feeder, since the insulating compound of the tube has a low melting point, and the contact surface of the flexible joint is too small, when it is considered that the joint is soldered with a composition of low conductivity and made by workmen who are not always over careful. Most of the break-downs and trouble which have occurred on Edison tubes have arisen from the joints, the solder becoming melted and the settling of one tube pulling the joint apart and opening the circuit.

The limited carrying capacity of Edison tube feeders, together with the uncertainty of their operation, has been the most potent influence in displacing feeder tubes by cables drawn in ducts, since reliability of service is absolutely essential in the management of a central station supply company.

American Types of Automobiles—II.

AMERICAN ELECTRIC VEHICLE COMPANY.

By S. S. Sherman.

As an example for description of the type of automobiles made by the American Electric Vehicle Company, of Chicago, the "runabout" buggy will be selected, which, while on exhibition at the recent Electrical Show, at Madison Square Garden,

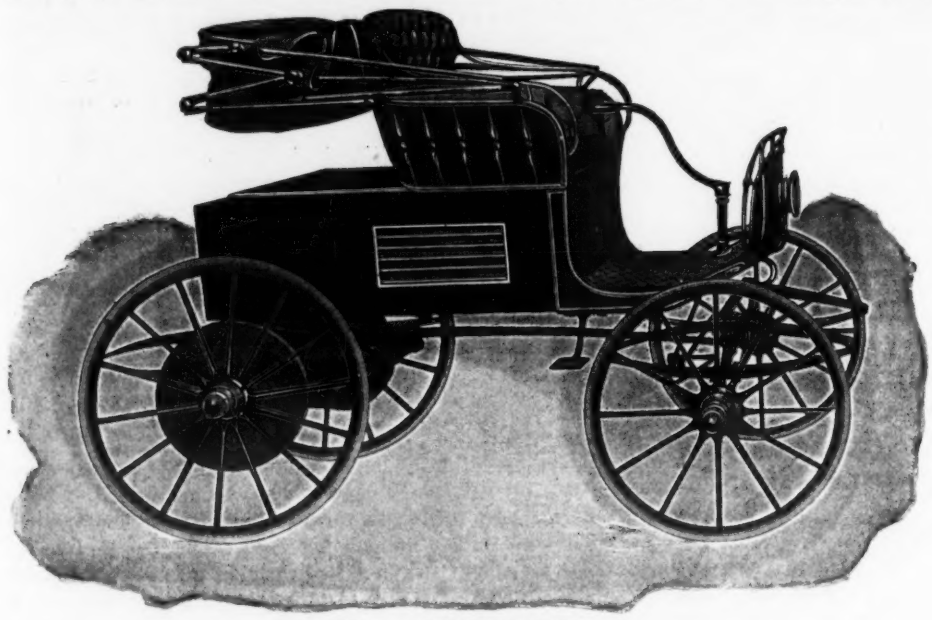


FIG. 1.—RUNABOUT BUGGY.

formed one of the chief attractions in the automobile section there.

The "runabout" buggy is a light, convenient and serviceable little vehicle for general business and pleasure needs. It is strong enough to stand travel over car tracks and cobble stone pavements, and fast enough for boulevard use. In appearance it resembles an ordinary buggy without the shafts. It has a single seat on which two can sit comfortably, and is intended for the use of one or two at pleasure. It is 8 feet long, 5½ feet high and has a tread of 52 inches. The front, or steering, wheels are 34 inches in diameter, and rear wheels four inches larger. All axles are ball bearing. The wheels are made of the best hickory and are fitted with heavy cushion rubber tires. The wagon box is built of hard wood, handsomely finished. The weight of the entire vehicle as it stands on the road ready for use is approximately 1400 pounds.

The buggy is propelled by a single motor, operated by current from a storage battery. The motor is located in front of the middle of the rear axle and acts, through appropriate gearing, on the hind wheels. The storage battery is placed under the seat of the vehicle, in the wagon box. The controlling and steering devices are put on the left side of the vehicle, within easy reach of the person sitting on the seat. Convenient to one foot is the brake lever and near the other is the button of the electric gong. In selecting the left side for the operator's place, as in most automobile vehicles, a common sense change was made from the usual position in handling horses, since almost all passing of other vehicles is made to the right, and the operator needs most to see his left wheel.

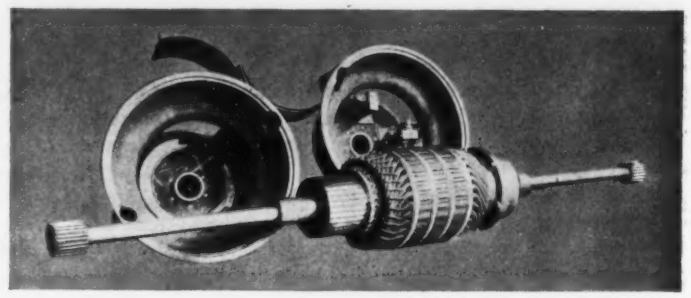


FIG. 2.—ARMATURE, SHAFTS AND PORTIONS OF MOTOR CASING.

The running gear of the buggy is simple and yet strong. A pair of steel springs connect the front of the wagon box with what is ordinarily the front axle. This cross bar of forged steel is, however, merely a support for the wheel axles, which join at either end in two vertical steering heads. To these upright joints are attached the rod which is operated by the steering lever inside the buggy. A clever knuckle in the steering head takes up the loose motion and prevents vibration of the handle, even on a rough road. The rear axle is the same as on an ordinary buggy, except that the motor is attached to it. It is reinforced in front by another bar running parallel to it and serving as a part of the motor support. A steel tongue connects the rigid outside casing of the motor with the front axle.

The motor itself, with its gears and shafts, is entirely enclosed in a steel casing which is so well fitted that the hose can be turned on it in washing the buggy without the least fear of damage. Even the brake is housed inside the casing, and, being always kept clean, is correspondingly reliable in its operation. This casing is bolted to the rear axle and its supplementary bar. It is made in three pieces, one of which forms a portion of the field magnets and supports them, while the other two are hoods fitting over the opposite sides of the armature, and provided with hinged caps, which can be opened to allow easy access to the commutator and brake disc. One of these hoods supports the brush holders and the other the brake clutch.

The armature shaft is hollow. One end of it terminates in a cylinder holding the single reduction differential gear. From this cylinder two steel shafts run out to the rear wheels, provided with pinions which mesh on the inside of large gears keyed to the hubs. The ratio of gearing is 1 to 12. The differential gear takes care of the curves, putting the motive power on the outside wheel in all turns, and is made necessary by the fact that only one motor is used on the vehicle. The cylinder enclosing the gear is used as a drum for the brake, two small friction clutches grasping it when the brake lever is thrown, and releasing automatically when the pressure of the operator's foot is removed. The bearings are self adjusting and lubricated by means of grease cups. The gears run in vaseline.

The field frame of the motor is 4½ inches wide and has four coils, which are wound separately, set in the field frame and held by triangular wooden wedges. The connections for the armature and field are made at the top of the field coils, the wires coming in through a special waterproof joint.

The armature, as has been stated, is mounted on a hollow shaft, at one end of which is the commutator and at the other the differ-

ential gear box. The armature is of the Siemens type with a core built up of insulated iron stampings. The coils are wound on wooden forms and are slipped in place easily. The brushes stand 90 degrees apart and are two in number, supported by being attached to the inside of the motor casing. The brake shoes or clamps are fastened in a similar position on the inside of the other half of the casing.

The entire motor is 11 inches in diameter and weighs 180 pounds complete, including its supports. It is series wound and planned to take 22 amperes at 85 volts as its largest current when making a speed of 600 r. p. m. The maximum speed, however, is 1400 r. p. m., when the field is shunted. This will require 12 to 14 amperes and will give a speed to the vehicle on a level, average road of a little better than 14 miles an hour. In normal use the field does not

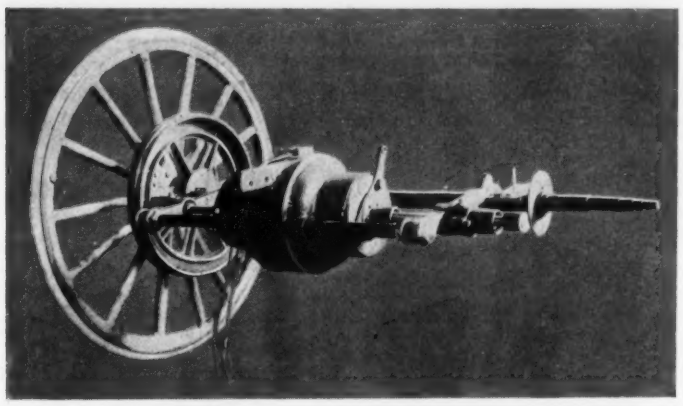


FIG. 3.—SUPPORTS AND GEARING OF MOTOR.

reach saturation. This enables the motor to do economical work on a bad road or climbing grades. After one hour's continuous run on maximum current, the temperature of the field and armature has been found not to exceed 70 degrees C. above the surrounding air. This motor is known as type H, of the American Vehicle Company.

The storage battery which supplies the current is one of the most interesting parts of the vehicle. It is known as the standard battery of the American Electric Vehicle Company, and is covered by patents granted to Mr. H. G. Osburn, engineer of the company. Naturally, it is built to give the greatest amount of output with the

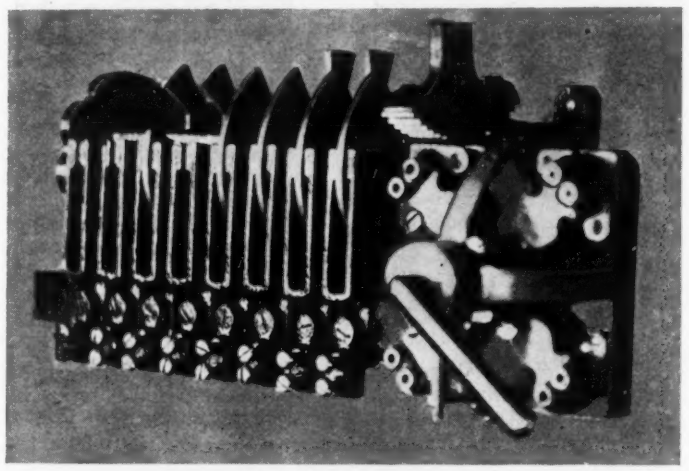


FIG. 4.—CONTROLLER AND SWITCH.

least amount of weight, and is made both cheaply and quickly, yet proving efficient in use. A battery ordinarily lasts a vehicle from 1½ to 2 years, and the cost of replacing the positive plates at the end of that time is far less than the sum which would have been required to keep a horse shod.

The lead grids for the positive plates are stamped in presses into a network of metal admirably adapted to hold the active element, and at the same time to furnish a connection to all parts of it. The plate is formed from a thin sheet of rolled lead. Rows of small square holes are punched into the lead; diagonal cuts are then made from the corners of the holes, and the flap thus formed is turned at right angles to the surface of the plate, thus forming a series of pockets for containing the active material. The thickness of the completed plate is thus equal to the sum of the thickness of the lead and the pockets formed by the portions turned at right angles. The opposite faces of the upturned portions form the side walls of adjacent pockets, while the greater portion of the edges are brought into contact with the active material, the only portions of the plate thus not in contact being the side edges of the sections This insures a maximum amount of surface to the active material, therefore resulting in a maximum rate of discharge for a given weight. After the grids are stamped, a mixture of finely divided lead and lead oxide is placed in them under heavy pressure. They are then formed. The positive plates are separated from the negative plates, in making up the cells, by thin pieces of wood, sawed in cross directions so as to form small gratings These wooden insulators are treated chemically and made water and acid proof, so that they closely resemble vulcanite. The completed cells are held together with rubber clamps and

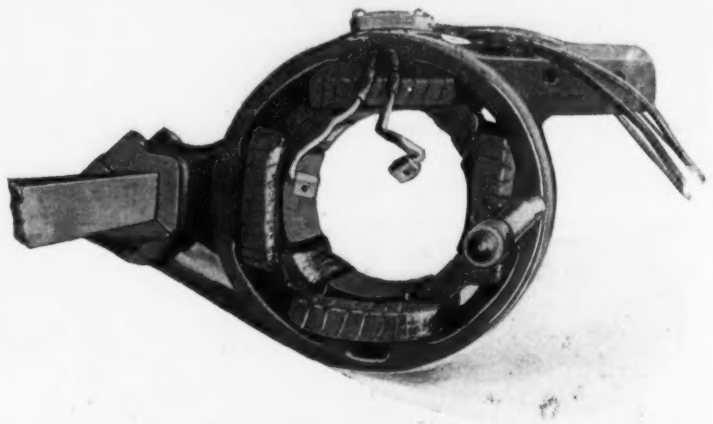


FIG. 5.—FIELD COILS.

put in hard rubber jars closed at the top except for small openings. Diluted sulphuric acid is the electrolyte.

The cells for the "runabout buggy" are 42 in number, each of the 90-ampere-hour size. In estimating ampere-hours the American Electric Vehicle Company calculates the capacity as discharged in 5 hours, instead of 10, as is more usual. On a ten-hour discharge the capacity of the cells exceeds 100-ampere-hours. The plates for the 90-ampere-hour cell are 3 inches wide and 7¾ inches high to the top of the active matter. There are nine positive and ten negative plates in each cell, the whole cell being 4¾ inches thick.

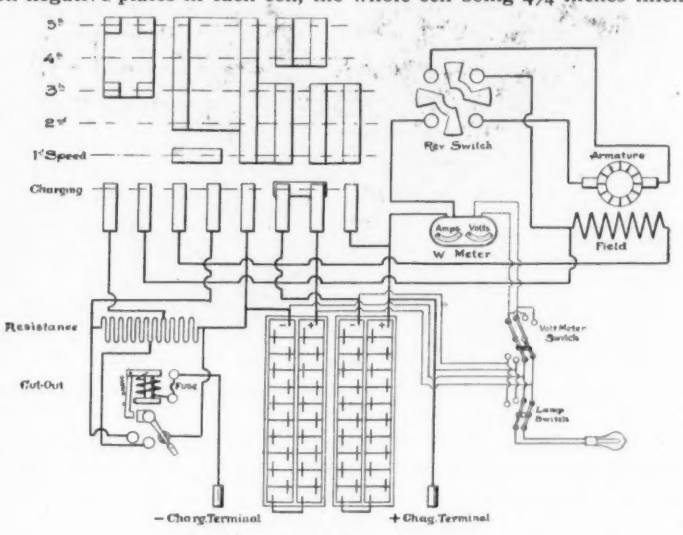


FIG. 6.—DIAGRAM OF CIRCUITS.

The weight of the completed cell is about 12½ pounds, and with the electrolyte, 15 pounds. The entire battery weighs 660 pounds.

A cell after charging has a potential of 2.205 volts. It is safe to discharge it to 1.8 volts, though this is seldom done. In practice, the complete battery has a voltage, on leaving the charging station, of 92½, which drops on the road to 86 to 89 volts during three hours' use. After that it usually goes still lower. The motor, as stated, takes current at the rate of from 10½ to 14 amperes in ordinary running. It is claimed that a laboratory test of the cells showed only 10 per cent. loss of charge after standing idle three months. What the battery will really do on the road is given later in the report of an expert test.

The wiring of the vehicle is cleverly arranged in the carriage body so as to be both concealed from view and easily accessible. By

the method of installation used, the batteries can be charged in the vehicle without damage, since the wires and controlling devices are entirely protected from the acid fumes. Four leads go from the motor to the controller, that number being necessary to give a reversed current in the armature when it is desired to back up. An electric light in the centre of the dashboard and an electric gong are connected directly with the battery. A combination volt and ammeter is put just in front of the dashboard. A resistance, the controller and a reversing switch are all located under the seat, in front of the battery and easy of access.

The switch and controller are simple and durable in construction. The switch has an interlocking arrangement with the controlling lever so that the lever must be locked in an upright, or no-current, position before the key can be removed. This arrangement is especially valuable in charging, since it prevents mistakes, and also makes it impossible to reverse the current when the controller is turned on. When the controller lever is upright and the switch is open, the key can be removed and carried in the pocket, thus guarding against the use of the vehicle while the operator is away. Reversing the direction of motion of the vehicle needs but the touch of the hand.

The controller is designed for 5 speeds, approximately 3½, 5, 8, 12 and 14 miles an hour. The first step of the controller handle puts two rows of the battery in parallel and the resistance in series with the motor circuit. The second cuts out the resistance. The third leaves the batteries still the same but puts a portion of the resistance in shunt across the field terminals. The fourth step puts all the batteries in series and cuts out the shunt. The last step puts in the shunt again.

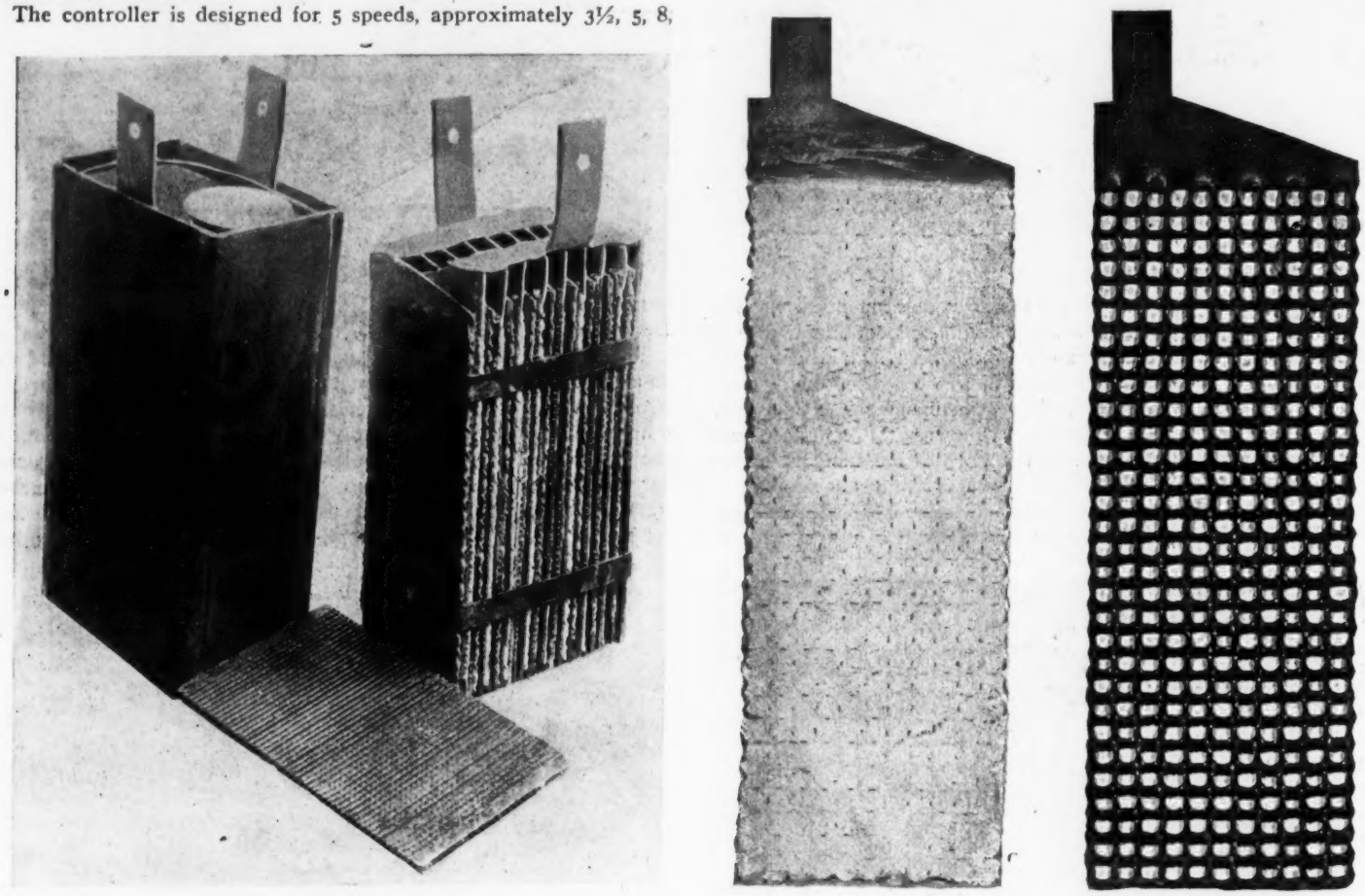
When the controller handle is in the upright, or no-current position, the connections are ready for charging the batteries. In the charging circuit is placed a cut-out that shuts off the current when the latter gets as weak as 2½ or 3 amperes. A fuse wire is added for protection in case of a shortcircuit. A three-step regulating device is connected to the resistance in the buggy, and three different values of current are available for charging purposes.

Mr. G. W. Knox, electrical engineer of the Chicago City Railway Company, recently made a test of the merits of the "runabout buggy" of the American Electric Vehicle Company. The feature of his investigations was a record-breaking test run which he made in a "runabout buggy," in which, with 48 cells of an 80-ampere-hour type of battery, he covered 61.5 miles on one charge, and decided the battery was certainly good for several miles more. Following is an extract from his report of the trip.

"The day was clear, but with a heavy shifting head wind which ran as high as 30 to 35 miles an hour. More than three-quarter of the distance of the run was against the heavy head wind, retarding our progress very materially, and, of course, increasing the power consumption greatly over and above normal conditions.

"The roadway run upon was about two-fifths of the distance asphalt, the remainder being principally macadam, with some brick, granite and wood blocks. The road was quite uneven and rough in many places, and we had about 20 grades to ascend, ranging from 1½ per cent. to 3½ per cent.

"The vehicle complete, with batteries, motors and balance of equipment, weighed 1125 pounds. In the carriage besides myself was a man weighing 209 pounds, our combined weight being 375 pounds, thus making the total weight of the vehicle, equipment and load 1500 pounds. The current consumption in making a start from a dead standstill was at a maximum of 35 amperes, the throw of the ammeter needle showing 10, 20 and 35 amperes; the most of the starts, however, represented 10, 15 and 25 amperes throws.



FIGS. 7, 8 AND 9.—DETAILS OF STORAGE BATTERY.

"The maximum running current against the strongest gusts of the high head winds was 18 amperes. The average running current was about 12 amperes, but at times ran as low as 10 amperes. The current consumption in ascending the heaviest grades—3½ per cent., from 200 to 300 feet long—was 15 amperes.

"At the start of the run the odometer registered 18 miles. At the finish it registered 79.5 miles, making a run of 61.5 miles. I will state here, that upon examining the odometer at the conclusion of the run, I found that it would occasionally fail to register; and there was undoubtedly a greater distance gone over than was registered.

"The speed of the vehicle at the end of the run was at a good rate, and had not decreased more than 25 per cent., and I believe from 5 to 8 miles more could easily have been gotten out of the batteries before they might have been considered run out. The voltage of the 48 cells at the conclusion of the run was 97½, thus showing per cell 2.03 volts, which represents a drop from initial potential of each cell of but .09 volts, which is certainly a very low reduction from the initial considering the amount of work accomplished."

The American Electric Vehicle Company, which is a pioneer in the automobile field, is now engaged in the manufacture of 50 of the "runabout buggies" and 30 assorted vehicles of other types, principally delivery wagons. The officers of the company are: President, C. J. Richards; vice-president and general manager, C. E. Corrigan; secretary and treasurer, A. H. Gilbert; chief engineer, H. G. Osburn; designing engineer, Korsten Knudsen.

CURRENT NEWS AND NOTES.

NEW YORK POLICE.—In his annual report, Chief Devery has recommended that steam launches be substituted for the naphtha launches now in use; that private police telephone lines be established in the borough of Queens, and that in all precincts separate direct telephone lines be provided.

STATUE OF HELMHOLTZ.—A statue or monument in honor of Prof. von Helmholtz has been unveiled in front of the University of Berlin. The Emperor of Germany was present. The U. S. A. was represented by Mr. J. B. Jackson, of the American Embassy, a friend of Helmholtz, and by Prof. Stiles, who represents the United States Department of Agriculture.

BEAUTIES OF THE GERMAN LANGUAGE.—Our esteemed contemporary, *L'Industrie Electrique,* which occasionally indulges in humorous notes, contains the following: "Synthetic languages are convenient, but they sometimes lead to curious results. Thus an automobile in German is designated by a very consonant and plain word. Here it is in all its simplicity: Selbstfahrdroschke."

ATTACHMENT FOR ELECTRICAL RECORDING INSTRUMENTS.—A patent was issued June 13 to Mr. Joseph Wells, of Niagara Falls, for a means to eliminate the friction between the stylus and paper of recording instruments, and also prevent sticking of the stylus to the record paper. An electromagnet energized by alternating or pulsating currents is located with reference to the recording mechanism, so as to impart mechanical vibrations to the recording stylus, or to the support for the paper.

ENGLISH ENGINEERING CONFERENCE.—The second biennial engineering conference of the English Institution of Civil Engineers was held June 7 under the presidency of Sir W. H. Preece, K. C. B., F. R. S. Among the papers read which were received with particular interest was one by Mr. H. F Parshall on electric traction. In the discussion, the speakers admitted the backwardness of England in modern electric traction and frankly acknowledged that they had much to learn from America. A visit was made to the Siemens works, where there was a reception presided over by Sir W. H. Preece. Among the Americans present were Prof. R. B. Owens, Mr. W. J. Johnston and Mr. E. H. Johnson.

ALTERNATING CURRENT ELECTRIC RAILWAY.—A patent was granted June 13 to Max Deri, of Vienna, Austria, for an electric railway system which permits, without the employment of rotary transformers, the utilization of single-phase and polyphase alternating currents to advantage in electric railway traction. On one axle of a car there is an alternating current motor, and on the other a direct-current shunt-wound machine in combination with a storage battery. The alternating current motor takes current from the line at speeds most favorable to its economical operation, during which time the direct current machine is driven as a dynamo and charges the storage battery. In starting and at slow speeds, the direct-current machine takes current from the battery and operates the car, the alternating current motor being disconnected from the line. When running on an up grade both the direct and alternating current machines may operate.

Y. M. C. A. ELECTRICAL CLUB.—The current issue of *Men,* the organ of the Young Men's Christian Association, contains an article by Mr. George A. Damon, giving an interesting account of the electrical club which is conducted in connection with the Y. M. C. A. of Chicago, and of which Mr. Damon is the director. This club is composed of about sixty young men, and one of its prominent features is an electrical laboratory comprising apparatus worth nearly $1,000. To properly use this apparatus two courses in laboratory work are given in the evening, such courses forming part of the work of two electrical classes. Between April and June a series of ten weekly meetings are held, which are devoted to practical talks by electrical experts, to visits to the most interesting electric plants about the city, or to open discussions on timely electric topics. Twice a year the club gives an entertainment electrical in character, and once a year there is a banquet with special electrical features. The latest enterprise of the club is in the collection of a circulating library of practical electrical books.

SELF-COOLING CONDENSERS.—A paper read May 6 by Mr. Thomas K. Wilkinson before the Colorado Scientific Society of Denver, on the "Self-Cooling Condenser," gives some figures concerning the cost of installing a condenser of this type, of a capacity sufficient to condense the exhaust from two 500-hp engines. The basis of the estimate is on the supposition that the engines will exhaust 24,000 pounds of steam per hour. The apparatus consists of a tower 18 feet in diameter and 30 feet high, installed in place complete with suction tank distributor, all piping in the tower, circulating fan, driving pulley, belting and fan engine or electric motor; one condenser of the jet type with combined steam cylinders, the exhaust steam connection being 18 inches, the injection 10 inches and the discharge 12 inches; a supplementary feed water heater to receive the exhaust steam from the condenser pump and small fan engine; all necessary fittings and wrenches. The entire cost of the above-described apparatus is quoted at $8300. It was guaranteed that this apparatus would be capable of maintaining a vacuum of not less than 22 inches and from 22 to 26 inches, under all but the most unfavorable conditions of weather.

RULES FOR AUTOMOBILES have been adopted in France to secure safety to passengers, pedestrians and other vehicles. These require that the operating mechanism, steering gear and brakes meet the approval of an inspection board, and are, in brief, that: Each vehicle must bear the maker's name, the type of machine and the number of vehicle in that type, also the name and address of the owner. No one shall drive the automobile who is not the holder of a certificate of capacity from the prefect of the department in which he resides. The driver of an automobile must always have the regulator of the speed well in hand. In case of narrow or crowded thoroughfares, the speed must be reduced to a walking pace, and in no case must it exceed 18½ miles in the open country or 12½ miles an hour while passing houses. Racing is allowed, provided authorization is obtained from the prefect and the mayors are notified. In racing speed of 18½ miles an hour may be exceeded in the open country, but in passing houses the maximum of 12½ miles must not be exceeded. The approach of an automobile must be signaled by means of a horn. Each automobile must be provided with two side lights, one white and the other green.

SAFE AND BURGLAR ALARM SYSTEMS.—Among the patents issued June 13 are four on safe and burglar alarm systems, of which two are issued to Clyde Coleman, of Chicago, one to Henry O. Megaard, of Chicago, and the other to Henry F. Freed, of Harrisburg. The Coleman patents, which relate to the "barrier" system of protection, are voluminous, one containing 4 sheets of drawings and 22 claims, and the other 3 sheets of drawings and 19 claims. The first mentioned relates to a closed-circuit system with balanced relay or galvanometer in which there is provision for permitting the door of the guarded structure to be opened and closed during business hours, the main circuit remaining closed and protecting other structures. Means are provided for indicating during the day, when the door circuit is open, the condition of the system, so that any variation from the normal may be detected and remedied before the system is adjusted for the night. The alarm devices are disposed in a protected housing, which may be located in an exposed place or in an office, police station, etc., or even within the guarded structure itself; and means are provided whereby such devices may be tested from the guarded structure end of the system or other point. Means are also provided for continuing the operation of the alarm mechanism when once it is set in operation, even though the main or controlling circuit be restored to normal condition. The other Coleman patent relates to further details of the above system. The Megaard patent also relates to the "barrier" system of protection, and provides means for obviating some faults to which, it is claimed, the usual curtain "barrier" system is subject. The Freed patent relates to an electrical attachment to a safe lock and locking bolts whereby an alarm is sounded should the lock or door be tampered with.

THE BRITISH PACIFIC CABLE.—An invitation has been sent to the governments of the British Colonies interested in the proposed Pacific cable to appoint delegates to discuss the matter further with the Colonial Secretary and the Chancellor of the Exchequer. The mode of raising the necessary capital and the manner of construction and control of the cable are to be considered.

MOTORMEN WANTED IN COREA.—Mr. H. B. Bostwick, chief engineer of the syndicate which is constructing the first street railway in Seoul, the capital of Corea, has sent to San Francisco for 10 or 15 experienced motormen and first class electrical engineers to go to Corea immediately. The motormen will be supplied from San Francisco. Their wages have been fixed at $70 per month.

HORSE-POWER STORED IN ALUMINUM.—Dr. Goldschmidt, who invented that interesting little furnace which has been referred to a number of times in our columns, in which aluminum is used as a fuel, stated in a recent lecture that to produce one kilogram of aluminum one horse-power is required for about 40 hours. If one kilogram of aluminum is consumed in one of his furnaces in less than a minute, the energy produced represents about 15,000-hp.

ARC LAMP CARBON.—A patent issued June 13 to Daniel Bacon, of New York, describes an arc lamp carbon having a longitudinal groove extending inwardly as far as the limit of the crater which will be formed during the use of the carbon, but not to the centre or axis of the carbon. It is claimed that by means of such a groove, the size of the crater can be fixed, and thus for a given current and a given depth of groove, the time of burning of the carbon may be accurately fixed.

AN ELECTROLYTIC LAMP.—A patent issued June 13 to Mr. William E. Irish, Cleveland, O., describes a form of electrode of high conductivity, which is initially heated by an arc formed between an envelope of less conductivity. A core of refractory material, such as one of the oxides of the rare metals, is surrounded by carbon. The cores of an upper and lower electrode touch each other at all times, and are heated by the arc forming between the carbon envelope, thus becoming conductive, which cuts out the arc. The current will then continue to flow through the core, and thus maintain its incandescence and conductivity.

ANNUAL EXHIBITION AT SPRING GARDEN INSTITUTE, PHILADELPHIA.—The annual exhibition of the work of the day classes at Spring Garden Institute, of Philadelphia, was held last week. The electrical section, which was under the charge of Mr. C. Walton Swoope, was of more than usual interest. The Marconi system of wireless telegraphy was experimentally demonstrated by firing a cannon located 35 feet from the transmitter. The Wehnelt electrolytic interrupter was shown, and also the new Caldwell thermal interrupter. One of the most interesting exhibits was that of a Nernst lamp in operation. A series of experiments was shown, illustrating alternating current induction phenomena by means of the Elihu Thomson apparatus of spheres, disks and rings. The waterpail electric forge was a popular attraction as well as a display of magnificent discharges from Leyden jars connected with a specially constructed transformer.

MULTIPLE-CELL STORAGE BATTERY.—In a patent issued June 13 to Leonard Paget, of New York, a storage battery is described consisting of a number of cells in one containing vessel. The containing vessel is of non-conducting material, and in it, equally spaced, are a number of grid-like frames, also of non-conducting material, which form a support for the active material. These frames may be of any suitable non-conducting material which will not be injuriously acted upon by the current or electrolyte, such as hard rubber or celleloid, but are preferably made of an elastic non-conducting material such as well vulcanized soft rubber to permit the expansion of the active material and to hold it properly during expansion. The active material is placed in the frame on each side of a central perforated web or grid, and when formed one side of this frame electrode becomes the positive and the other the negative element. The electrolyte, of sulphuric acid, is held by an absorbent material, such as tripoli or pumice. The terminal elements are of but one polarity, and to these lugs are connected, by means which current is conducted to and from the battery.

IS WIRELESS TELEGRAPHY DANGEROUS?—The rather startling statement comes from Europe that the signalling across the channel by Marconi's apparatus may have caused shipwrecks. It is suggested that the Hertz waves as they pass through space may act on the compasses of vessels and cause the helmsman to alter his course unwittingly. A ship recently lost in the Channel was so badly out of her course as to make her position difficult to account for as being due solely to an error of the captain. The wreck took place just at the time when signals were being sent from the coast of Calais with Marconi's apparatus. It is stated also that the captain of the Ibis, a boat belonging to the French Navy, made some observations with a view to determining what effect the signals had on his ship's compass, and that he reached the conclusion that the effect was noticeable. The above we abstract from our Italian contemporary, *L'Eettricita.*

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical material, etc., are from the port of New York for the week ending June 13: Africa, 5 packages electrical material $788; Argentine Republic, 2 cases electrical material $48; British East Indies, 8 cases electrical material $48; British West Indies, 43 packages electrical material $873; Barcelona, 16 cases electrical material $250; Brussels, 7 cases electrical material $400; Brazil, 24 packages electrical material $1718; British Australia, 13 cases electrical machinery $398; British possessions in Africa, 105 packages electrical material $45, 2 crates electrical machinery $50; Cairo, 4 packages electrical material $433; Cuba, 22 packages electrical material $393; Copenhagen, 3 packages electrical material $63; Dublin, 1 package electrical material $26, 27 reels cable $10,568; French West Indies, 1 case electrical material $13; Glasgow, 3 cases electrical machinery $360; Hull, 16 cases electrical material $1748. 63 packages electrical machinery $1500; Helsingfors, 1 case electrical material $18; Hamburg, 92 packages electrical material $6786; Liverpool, 10 packages electrical material $394; London, 17 cases electrical machinery $416, 43 packages electrical material $1400; Mexico, 67 cases electrical material $976; Milan, 1 package electrical machinery $57; New Zealand, 4 cases electrical material $80; Porto Rico, 4 cases electrical material $165; Rotterdam, 4 cases electrical machinery $65; Southampton, 16 packages electrical material $2635, 20 cases electrical machinery $320; Venezuela, 11 packages electrical material $158; Warsaw, 4 packages electrical material $72.

EXPOSITION ILLUMINATION.—The remarkable progress made toward success by the Greater America Exposition to be held in Omaha from July 1 to Nov. 1 this year, is stimulating all the various departments in the organization to excel in as great a degree as possible the success of the Trans-Mississippi Exposition held in the same city last year. The electric department shares this sentiment, and has already replaced the greater part of the material taken down last year. It is intended to increase the quantity of light on the grounds considerably, and yet, at first, the way to increase it did not seem clear, since the quantity of power available was limited by the capacity and location of the boilers already in place. However, since the local city lighting plant has come forward with an offer to take care of the Midway commercial incandescent lighting, and all of the arc lights on the grounds, this difficulty has been removed, and the plant is able to furnish for decorative lighting 370-kw more current than last year. The engines used this year will be three Westinghouse compound, 375-hp each; one 250-hp Ball automatic high-speed; one 350-hp Atlas Corliss, and one 200-hp Armington-Sims high-speed. The generating equipment will consist of General Electric generators as follows: Two 180-kw A. C., 125 cycles; four 120-kw A. C. generators; two 75-kw, D. C. 500-volt generators, and one 125-light Brush arc machine, four-circuit. All of the currents in the Grand Court and Bluff Tract, where overhead wires would be unsightly, will be delivered by means of underground lead covered cable, furnished by the Safety Insulated Wire & Cable Company, New York, of which cable there is approximately 15 miles. The arc lamps furnished by the local electric company will be of the alternating series enclosed type, and current for them will be converted by means of General Electric transformers of 100 lamps capacity. This system of alternating arcs is a new departure in exposition lighting. The boilers used will be the same ones in service last year. The battery consists of four 500-hp and two 250-hp Morrin Climax water tube boilers, carrying steam at a pressure of 130 pounds. The piping and fitting necessary is extra heavy and cleverly arranged.

LETTER TO THE EDITORS.

Early History of the Electric Railway.

To the Editors of Electrical World and Engineer:

Sirs:—I was much interested in the article in your paper of June 10 relative to Edison's early work in electric railways. It recalled to my mind some of my early efforts to interest others in my own work in those days. I happen to have at hand copies of a few of the hundreds of letters which were written in connection with my early efforts and enclose you same. Just note my prophecy in my letter of Oct. 27, 1883, when writing to C. B. Holmes, of Chicago, so widely known at that time in street railway circles. Before 1893 the horse had gone, and we know that attempts were being made to operate the steam roads. In 1882 and 1883 I tried to interest Elkins and Widener and Kemble here in connection with the Chestnut and Walnut Street railway line. My inventions were adopted on that line in 1892. These few letters show at least the strong interest I felt in the future of electric railroading, especially for street service. I recall that on June 16, 1883, your paper published an article relating to my inventions in this work. I have the satisfaction of knowing that my ideas of the future of this work were correct.

Philadelphia, Pa. R. M. HUNTER.

[The correspondence to which Mr. Hunter refers is printed in pamphlet form and consists of letters dating from March 9, 1883, to Nov. 19, 1885, and bearing the signatures of Mr. Hunter and various persons whose interest he endeavored to enlist in the raising of capital. In a letter to Mr. C. B. Holmes, president of the Chicago City Railway Company, Mr. Hunter says: "I think that in less than ten years, electric railways will be the system of locomotion on all small and medium-sized trams and railways, and may be adopted on large railways to a considerable extent." In another letter, dated Oct. 10, he says: "You may depend upon it, it will be a larger thing than the telephone ever was or ever will be." In another he claims that his system for electric railways is the only practical one for long distances or for street cars when a large number of cars are run. In another he says that he has practically 125 to 150 inventions relative to circuits, roadbeds, generators, motors, regulators, signals, etc., for electric railways. In a letter to a London correspondent Mr. Hunter asks $2,000,000 for the use of his inventions in all Europe. In this letter he states that the only expense would be for the railway motor, the size of which will be dependent upon the weight of the car and load, and grade of roadbed, and adds that a machine selling on the market for $250 to $300 could be made for $50, while the motor connections would cost but a trifle.

Even the year 1883, the earliest date of the Hunter letters, is, however, rather late in the early history of the electric railway upon which to base a prophecy as to its practicability. As early as 1879 Siemens & Halske operated an experimental third-rail railway line 500 meters long, at the Berlin Exhibition of that year. In 1881 the overhead conductor electric railway of the same firm divided honors at the Paris Electrical Exposition with the Edison system of incandescent electric lighting. On May 12, 1881, the Lichterfeld line in Germany was opened to traffic, and in 1883 we read that the road up to that time had been operated without a single day's interruption. In 1881 the commercial operation of the Berlin-Charlottenberg road was also begun. In 1883 the road at Brighton, England (1 mile) and that at Portrush, Ireland (6 miles), were opened to traffic.—EDS.]

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.
By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS

Testing Dynamos.—Mr. Fischer-Hinnen, who is quite an authority on dynamo construction, contributes a long communication in the *Elek. Zeit.*, June 1, in connection with the recent discussion in that journal. He gives the results of practical experience in testing all of the machines made by a certain company. He has found that the friction loss at a constant speed increases quite rapidly with the excitation and he attributes it to the side pull on the armature due to slight eccentricity. To show what this pull amounts to, he applied Maxwell's formula and the result showed that this magnetic pull cannot be neglected, especially in large machines. He gives a formula for the total no-load loss at constant speed, but it does not seem to be in a practical form. The effect of the magnetic pull on the bearing friction is especially noticeable in starting the machine; it took 6.2 kg applied by the belt to start the machine when not excited and 20-kg when it was excited; in a larger machine it was 20 in the first case and from 40 to 90 in the second. In general he believes it can be assumed that the friction coefficient, considering the magnetic pull, will be about 8 to 10 fold at the start, as compared with that at the normal speed; this he suggests is made with street railway motors. He does not agree with the recent statements of Liebenow and states that according to his own experience the friction coefficient varies between 0.038 and 0.06 with a surface speed of 2 to 2.5 meters. The losses due to hysteresis and Foucault currents, increase quite rapidly with the load. He gives the formulas for the hysteresis loss, and the Foucault currents in the iron and copper, which he uses in calculating machines and which he states give results agreeing quite well with the results of tests. In conclusion he gives some formulas and data concerning the loss in brushes, showing that in the determination of the efficiency of a dynamo this loss cannot be neglected. With normal machines from 100 to 125 volts the losses will be about as follows: for metallic brushes the loss by the Joule effect is 0.4 to 1.2 per cent. and that due to friction 0.2 to 0.5; with carbon brushes these figures are 1 to 2 per cent. and 0.5 to 1 per cent. The loss will be least when these two losses are equal and on this he basis simple formulas giving the best cross-section of the brushes and the least loss in the brushes. For a surface speed of the commutator, equal to 8 meters per second, the total brush loss will be at least about 0.8 to 1 per cent. for metallic brushes, and at least 2.5 to 3 per cent. for carbon brushes.—FISCHER-HINNEN. *Elek. Zeit.*, June 1.

Friction Losses in Dynamos.—In a long article by Dettmar which is begun in the *Elek. Zeit.*, June 1, he discusses in some detail the question of friction losses about which there has been some discussion in the reecnt numbers of that journal. He claims that the loss of work in friction is not proportional to the speed but increases rapidly with it; he refers to the sum of all the various friction losses in a dynamo; this difference is not due to the effect of air friction, but is really an increase in the frictional coefficient, which is variable. He discusses the three methods of measuring the losses in dynamo. The first by means of a calibrated motor, the second by running the machine as a motor unloaded, and the third by driving it up to speed and then letting it run down without doing any other work than overcoming the friction; the second method was described in his article noticed in the Digest April 8. The first method is not satisfactory unless the motor is directly coupled and not greatly loaded; it is of use when no convenient source of current for the other methods is at hand. The second method is simple and exact and the third involves difficulties in its application to determining the losses in absolute values, owing to the necessity of having to know such quantities as the moment of inertia, but it is a very convenient one for determining relative values, that is, for finding the condition of the bearings at any time; sometimes the two methods can be combined to advantage, one of the first two being used for determining the absolute values which are then used with the relative values determined by the third method. The latter he discusses in some detail, giving the equations. He suggests in place of a tachometer which absorbs too much power, to use a voltmeter for determining the speed, measuring the voltage due to the remnant magnetism, having first calibrated the voltmeter at some known speed; in other cases a revolution counter like a bicycle cyclometer can be used. Extended tests are described to determine the laws governing the friction losses, they were made with a shaft so as to eliminate air friction. The first law which he formulates is that at constant bearing temperature and specific pressure, the friction coefficient and therefore

the loss of energy due to the friction, increases with the 1.5th power of the surface speed; the nature of the oil changes the absolute, but not the relative values. There is a variation of this law but it refers to speeds much lower than those occurring in practice in connection with dynamos. The exponents vary between 1.3 and 1.55, the former for small and the latter for large machines; for the bearing friction alone they lie between 1.4 and 1.6. The second law is that at constant temperature and surface speed, the friction loss is inversely proportional to the specific pressure and therefore the loss of work is independent of the pressure, as long as it is lower than 30 to 44-kg per sq. cm. The product of the friction coefficient and the specific pressure is a constant for all speeds and therefore the friction loss is the same when the machine is driven with a belt as when run unloaded, and is independent of the tension on the belt, provided it does not exceed the pressure above mentioned. The product of the temperature and the friction coefficient is shown to be a constant, from which follows the third law, that at a constant specific pressure and constant surface speed, the friction coefficient is inversely proportional to the temperature of the bearing and therefore the loss in energy is inversely proportional to the temperature. The friction coefficients are therefore dependent on the surface speeds, the specific pressure, and the temperature. The temperature of a bearing does not become constant until the machine has been run about 4.5 hours and any friction tests made before such a run, will not give the proper values and involve a correction which may be quite appreciable. In the next portion he intends to give the formulas for the predetermination of the friction losses.—DETTMAR. *Elek Zeit.*, June 1.

Transformer Cores.—In a short article by Mr. Scott in the *Lond. Elec.*, June 2, he summarizes briefly the causes of the variation of the hysteresis effect in transformer cores and draws some practical conclusions. As is already known the iron losses increase with the time, part of which is due to long continued overheating; in one test by Roget, for instance, it was found that by keeping a fair sample of iron for several days at a temperature of 160° C, the hysteresis was trebled. The stresses and especially a pressure on the core plates, also tend to increase the hysteresis loss; for instance, Mordey found that at 1500 pounds per square inch there was an increase of 21 per cent. in the core loss while on removing the pressure the loss came back to its original value. Parshall also found that increasing the pressure to 2200 pounds per square inch on a good sample, raised the hysteresis from 0.55 watts per pound at 100 cycles and 3700 lines per sq. cm. to 0.84, which is an increase of 53 per cent. In building up transformer cores it is usual to tighten the bolts as much as possible in order to get as much iron as possible into the space and to prevent noise. This, however, is now shown to be wrong practice, as it puts a pressure on the iron; care should be taken that only such stresses are used as are absolutely essential to good mechanical construction. Punching out the discs he considers a very objectionable method and he prefers cutting or guillotining.—SCOTT. *Lond. Elec.*, June 2.

REFERENCES.

Efficiency of Dynamos.—An article describing briefly various methods of measuring the efficiency and concluding with some measurements which he made with a small machine.—WERNER. *Elek. Anz., May 21.*

Variable Speed Induction Motors.—A translation in abstract with a number of curves, of the article noticed in the Digest, Dec. 3.—NIETHAMMER. *L'Eclairage Elec.*, May 27.

Armature Windings.—A correction of a statement in Arnold's book, concerning the question of the number of coils and whether the number must be odd or even.—EMDE. *Elek. Zeit.*, May 25.

LIGHTS AND LIGHTING.

L'Ind. Elec., May 25, abstracts these figures more briefly and adds that the consumption per candle-power shows that the enclosed arc has no gain in efficiency over incandescents of 3 watts per cp.

Train Lighting in Great Britain.—A short article on what is known as the Stone system, invented by Gill, and which seems to be the one which is used most largely in England; one line has 300 coaches fitted with electric lights, another 350 and several others about 200; the system is said to be in use on more than 100 railroads, including several in America. The essential feature is that a dynamo is placed underneath the carriage and is driven from the wheel axle; it is claimed that no matter what the variation of the driving speed, the dynamo always runs at a fixed speed, which is accomplished by mounting the dynamo so that it is suspended on links, free to swing, the pressure of the dynamo exerting a pull on the belt; when the speed of the train increases, the greater pull on the belt draws the dynamo toward the driving pulley and this causes the belt to slip, so that the armature revolves at a normal speed; the greater the speed of the car, the greater the slip of the belt. The result of some tests made by Prof. Slaby, of Berlin, are given. In connection with the dynamo there are two batteries of accumulators so that one can be charged while the other is running the lights. A centrifugal governor automatically switches the lamps from the batteries to the dynamos. No noticeable increase in coal consumption due to the power used to drive the dynamo, could be found. According to a laboratory test a half pound of coal per train mile on a train of 10 coaches would be the increased coal consumption. The increased first cost over a gas plant is somewhat over 50 per cent., but the operating costs are claimed to be very much in favor of electricity. The cost of the electric system including all expenses is given as 0.294 cents per hour for a 16-cp lamp while the oil gas would probably cost 0.418 cents per 8-cp lamp.—SHOLEY. *Cassier's Mag.*, June.

REFERENCES.

Nernst Lamp.—The recent paper of Nernst is reprinted in full in the *Elek. Anz.*, May 14, and in the *Zeit. f. Beleucht,* May 20. The former journal also contains the introductory remarks of Rathenau and the concluding remarks of Dr. Ochs. An abstract of the paper has already been referred to in the Digest.

Incandescent-Arc Lamps.—A short illustrated article with this title describing with illustrations some of the older forms of lamps in which both the arc and the incandescent principle are combined.—GRUENWALD. *Elek. Anz.*, May 7.

TRACTION.

Jungfrau Railroad.—A short note stating that the successors to the late Mr. Guyer-Zeller, who was the projector of this interesting mountain railroad, have decided to continue the construction of the railroad to the Eiger station and then to terminate it there; and it will therefore hereafter be known as the Eiger Railway. It was concluded that great climatic and technical difficulties would be encountered in continuing the project as originally planned to the top of the Jungfrau, and that to overcome these difficulties would require more capital than has been raised; it is also questioned whether the project would be a profitable one on account of the shortness of the season, which is still further reduced by the number of days when the weather would be bad. The Eiger station is only 700 meters below the top of the Eiger, the height of which is 3975 meters; the railroad will therefore mount to a height of 3275 meters (about 10,700 ft.); the top of the Jungfrau is 4167 meters.—*Elek. Neuigkeits Anzeiger,* June 1.

Milwaukee and Eastern Wisconsin.—A description of this system of electric railways is given in the *St. R'y Jour.*, June. The lines cover a territory occupied by 350,000 inhabitants, with 225 miles of track, and include the electric lighting system of Milwaukee. The track construction is a T-rail for city work and suburban. The rails are laid on wooden ties set in concrete; all joints are cast welded, and by the end of this year the company will have most of its track cast welded. To accommodate the expansion and contraction on exposed track, which has been found to amount to 1.25 per cent., slip joints are provided every 500 ft. The standard trolley wire is of a figure 8 section, and has been found most satisfactory. The feeders in the business district are laid in vitrified brick conduits. The company has at present seven power stations, but some of these will be abandoned after a new station which the company is building is completed. The total capacity of these stations is 4255-kw for the railway service, and 3552-kw for the lighting service. The present largest station contains eight triple-expansion marine type engines, of which five are direct-connected to two 200-kw railway generators, and three to two 100-kw generators, as well as three miscellaneous engines. The new station will contain two 1400-hp and two 1100-hp engines, and will be equipped with conomizers, coal conveying machinery and mechanical stokers. Both single-truck and double-truck cars are used, but double-truck cars are used almost exclusively, and are considered superior to the single-truck cars. On double-truck cars four motors are considered superior to two. Electric arc headlights are used, requiring 5 amperes, and are considered an excellent preventive of accidents. The company makes a careful provision for amortisement, which is fully described.—*St. R'y Jour.*, June.

Notes on Electric Railways in Germany.—The Int. Ed. of the *St. R'y Jour.*, June, contains an article on municipalization of tramways in Germany. This tendency has been dampened by the fact that in Darmstadt and Muelheim, where municipal roads are in operation, they have shown a deficit for the past year. He believes that mu-

nicipal roads cannot be run as cheaply or desirably as those under private ownership. He describes a high speed road between Düsseldorf and Krefeld, the cars on which are equipped with air brakes; a similar road is planned near Halle. Of late the authorities of the large cities have compelled all roads operating trail cars to use mechanical brakes acting simultaneously both motor and trail car. The air brake has been very popular for this purpose, although electric brakes are also used. German laws usually limit the width of the cars to 2 meters, which makes longitudinal seats a necessity; recently, however, some cities have allowed wider cars (in Düsseldorf 2.1 meters). Dr. Kallman, city electrician of Berlin, has made some researches in regard to return circuits on electric railways, and recommends the unipotential system. In some tests made on the Berlin roads he finds that the drop on the rails can be kept within one volt, although the cost of the feeder construction is somewhat larger. A summary is given of the annual reports of the tramway companies at Leipzig, Dresden, Hamburg, Berlin and Breslau, showing an increase of traffic, but one not commensurate with the increase in car-km run.—*St. R'y Jour.*, June.

Rail Welding.—Mr. Kleinschmidt, in the *St. R'y Jour.*, June, discusses the present status of the electric welding of rails. When this method was first used a change was noticed in the nature of the steel, which for a long time was attributed to the electric current; it was finally discovered that rail joints could be effectively welded by using around the joint a form of fishplate with heavy bosses at each end. As the boss is the only portion of the bar which comes in contact with the rail, all the heat is concentrated at that point, and as soon as a heat sufficient for welding is reached the current is cut off and a heavy pressure is exerted over the weld. An artificial means is provided for hastening its cooling while under pressure. This process has been shown to have no deleterious effect on the rail, and even with a strain of over 250,000 pounds it has been impossible to break off a weld made in this way. Last summer 10 miles of tracks were welded in Brooklyn during the hot weather, with no provision for expansion and contraction, and last winter only 1 out of 180 joints broke, in each of which the rails had previously had twelve holes punched in them for the fishplate bolts. It was also found that rails with punched holes were very much weaker than rails with drilled holes, and where holes have been punched in the rails the company now reams out the holes before welding. It is thought that with new rails having no holes, or rails in which the holes were drilled instead of punched, a break will be an extremely rare occurrence. The company has commenced the electric welding of 50 miles of track in Buffalo.—KLEINSCHMIDT. *St. R'y Jour.*, June.

Trucks for Electric Cars.—Mr. Peckham, in the *St. R'y Jour.*, June, replies to an article in the last issue of that journal by Brill. A comparison with the trucks of locomotives is not a good one, as the objects in the two are entirely different. With the locomotive it is to hold the wheels in alignment and to take up horizontal stresses, while with the electric truck it is to carry a load without oscillation, and accomplish the latter a long spring base is necessary. He discusses these points by means of diagrams, and defends the use of riveted truck frames which were criticised in the last issue. The argument presented last month would apply to all structural work under strains, including railroad bridges where the jars and strains upon the members are greatly in excess of those encountered under an electric car. He also says that as trucks are made in a shop the riveting can be much more carefully done than in bridges, where it is performed out doors on the work. He will continue the discussion in a later issue.—PECKHAM. *St. R'y Jour.*, June.

Repair Shops.—An article on labor-saving devices in a repair shop in Cincinnati is published in the *St. R'y Jour.*, June. The company casts its own commutators from scrap trolley wire that has been melted. A hand hydraulic press for putting on and taking off commutators is illustrated, also a machine for winding coils with tape, consisting of two rings, and somewhat similar to a device for the purpose illustrated in the same paper last month, but the speed of the rings is controlled by foot power. Another cut shows a device for testing motors. The motors are geared to a shaft and driven as generators, the current from them being sent through a resistance. For painting field coils and armatures the company uses asphalt paint. Two sets of carbon brushes are used for each car motor and each generator. In summer the brushes are changed every day, and as soon as received are placed in a pan of sperm oil, in which they are kept until again in use. The brushes are numbered and lettered, and are placed on the same commutators. In winter they are allowed to run three days before changing. The result is to give a very long life to both brushes and commutator. Two sets of brushes last a year, and the commutators sometimes last for three years. The company also makes its own trolley wheels from a mixture of eight parts of copper to one of tin. The trolley wheels are turned out on an automatic lathe, which cuts the sides and the grooves of the wheel at one operation. One unskilled workman can finish 125 wheels a day. —*St. R'y Jour.*, June.

Testing Armatures.—A method used by a Jersey City traction company for testing armatures after they have been repaired, is described in the *St. R'y Jour.*, June. A motor field is mounted rigidly in a wooden frame, and adjoining it in the same frame is a second motor field arranged so that it can be slid in a direction parallel to its armature shaft, enabling the shafts of the two motors to be kept in line. The two armatures to be tested are then placed in the motors, the pinions coming opposite each other. A sleeve is slipped over the pinions, having six screws, which fit between the teeth and hold the pinions rigidly together. One motor is then run as a generator, and its current passed through a water rheostat. After a test of about seven and a half minutes the connections are changed, so that the former generator becomes a motor, and the former motor a generator, thoroughly testing both machines.—*St. R'y Jour.*, June.

Electric Vehicles.—An article giving illustrated descriptions of the types of electric vehicles made by a German company, is published in the *Elek. Zeit.*, May 25. The first type described is an omnibus. It has two motors; the front wheels seem to have knuckle joints for steering; all the bearings are fitted with balls and need attention only every two or three months; speed regulations are obtained by connecting both the two halves of the battery, and the two motors, variously in series and parallel, and also shunting the field magnets; some of the energy set free in braking is restored to the batteries; on the roof of the car there are two sets of bar contacts for charging from overhead wires; there are 44 cells of accumulators; it is supposed that the length of an average trip is 9 miles, and as the batteries will run 12, the reserve is thought to be ample; it is recommended to refresh the batteries with a charge after about every 4.8 miles in order to prevent any possible failure; the duration of such partial recharges is only 15 minutes. The omnibus is intended for 18 paying passengers; its weight with battery (but apparently without passengers) is 3500-kg, which it is thought can be considerably reduced. The next form described is an open pleasure carriage for a number of passengers. The lower part is arranged for any desired carriage body that may be placed on to it, and is intended for live loads of 500 to 1000-kg. This framework has only one motor; the rear wheels are the drivers; all bearings are provided with balls; the two halves of the batteries are connected in series or multiple and the magnets of the motor can be shunted. The capacity of the accumulators suffices for 25 to 30-km; the usual round trip for such vehicles is thought to be about 15-km, and there is therefore an ample reserve. When used for pleasure driving the wheels are provided with rubber tires, but for business purposes, for the mail, and for package delivery, rubber tires are claimed to be an unnecessary expense in both first cost and cost of maintenance. The last one described is a carriage for three to four persons, besides the driver. Any desired car body may be placed on the standard form of truck adopted by them. There are two motors driving the hind wheels; there is a foot brake and an electric emergency brake; there are four points to the controllers and the battery is not subdivided into groups; the speed of the loaded carriage can be brought up to 20-km (12 miles) per hour, the weight unloaded being 1100-kg. The capacity of the battery for normal trips is about 40-km and it is intended to use it for 30-km; a partial recharge after 10 to 15-km requires one-quarter of an hour. In conclusion, the results of some measurements during two trips are given. During a measured trip of nearly four miles with a loaded vehicle weighing 5.1 tons, the consumption (measured apparently at the terminals of the battery during discharge) was at the rate of 80.5 watt-hours per ton-km, the speed being 4.3 meters per second. In another test with a vehicle weighing loaded 4.23 tons over a trip of about 14-km in 59 minutes, the consumption was 77.2 watt-hours per ton-km.—WILKING. *Elek. Zeit.*, May 25.

Electric Traction in Great Britain.—In an editorial in the Lond. *Elec.*, June 2, some comparisons are made between traction in that country and America. It is claimed that except in respect to mileage of track, the best electric tramways in Great Britain surpass anything yet accomplished abroad. They are claimed to be more elegant and durable in construction and less noisy in operation; in engineering work their efficiency is higher and financially they are more economical. It is claimed that the bulk of the American lines should be left severely alone, and that English engineers should study such

lines as those at Bristol, Leeds, Stockton, etc., instead of making trips to America.—Lond. *Elec.*, June 2.

Electric Power for Marine Propulsion.—In the *Eng. Mag.* for June Mr. Child gives some figures for the weight per horse-power of electrical machinery necessary to drive boats, for different periods of 1 to 20 hours. Assuming an average loss of 20 per cent. in the conversion of mechanical power and including the circuits, controllers, etc., the weight per hp-hour is equal to 234 pounds for a 1-hour run and 75 for a 20-hour run. A similar calculation is then made for steam engines and the figures are 57.5 and 5 respectively for the extreme cases; the steam equipment is therefore much lighter, but there are so many other elements to be considered that the advantage in many cases is in favor of electricity in spite of the great weight. As an illustration he refers to the steam ferry boats crossing the Hudson at New York, and shows that these could be equipped with electric propulsion, the batteries being charged from a station on shore while the boats are in their slip. Such a boat would require about 90 tons of batteries and 10 tons of motors to replace about 70 to 80 tons of engines, boilers, accessories and coal; the cost would be from $50,000 to $60,000, as against $37,000 for the steam equipment; but there would be a saving of at least four tons of coal per day, which would pay a large interest return on the additional investment. The advantages of electricity for high-speed boats is also discussed, a comparison being made between steam and electrically-operated torpedo boats, but the latter have the disadvantage of a small radius of action.—CHILD. *Eng. Mag.*, June.

Leeds.—Tabulated statements in detail of the receipts and expenditures of the railway lines for the year ending in March, 1899. The company is using horses, steam and electricity, and the working expenses per car-mile are less than half for electric traction than for either of the other two; electricity is soon to be applied to all of the lines.—Lond. *Elec. Rev.*, May 26.

Brooklyn.—An elaborate estimate of the earnings and operating expenses of the Brooklyn rapid transit system.—*St. R'y Jour.*, June.

Dayton and Western Traction Co.—An illustrated descriptive article of this cross-country road.—*St. R'y Jour.*, June.

Rail Bond.—A description of a new, one-piece bond, drop-forged in one piece with terminals and a body complete, made of pure copper.—*St. R'y Jour.*, June.

Compressed Air Cars.—A long article on those to be introduced on the cross-town lines in New York City, which differ radically from the type used in Europe.—*St. R'y Jour.*, June.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

The Watford Municipal Lighting Station is described in the Lond. *Elec.* and *Elec. Eng.*, June 2. The population of the town is about 30,000; the system used is the high pressure alternating one with transformers and a distribution one at low pressure; the buildings are combined with those of the new sewerage works in that town. One of the features of novelty is that this is the first plant which has adopted the Mordey inductive alternator system. Paper insulated cables are adopted throughout; there are about 5.5 miles of high tension cables of the concentric type, the voltage being 2000; this is transformed down to 200 for private lighting and down to 400 for public lighting. The transformer boxes which are used are illustrated.—Lond. *Elec.*, June 2.

ELECTRO-PHYSICS AND MAGNETISM.

Magnetic Qualities of Cast Iron and Steel.—Mr. Summers recently read a very long paper before the Iron and Steel Institute in London, in which he gives the results of what appears to have been a very extended research concerning the composition of cast iron and steel, and more especially an examination of the chemical composition and its relation to the physical structure. The portion referring to the magnetic properties is abstracted at considerable length in the Lond. *Elec. Eng.*, May 26, in which quite a number of the magnetic curves are reproduced. While the researches appear to have been very extended, it does not seem that more than a few results of general interest and importance were obtained. There is no general summary given in connection with the paper, but the following remarks may be of some interest. Considering the effects of chemical composition on permeability, he shows that magnetism and permeability seem to be properties of the iron itself, but are influenced to a very great degree by the metalloids commonly associated with iron. He claims that in nearly every case it can be "assumed that magnetism and magnetic permeability are opposed to each other and a state of the metal favorable to one may be unfavorable to the other." It is exceedingly difficult to draw any trustworthy conclusions concerning cast iron, as the large contents of metalloids make it almost impossible to trace variations in permeability to any one or any combinations of the metalloids. Special alloys were made and tested, some of the more characteristic curves being reproduced. From these he seems to conclude that silicon has probably little or no direct effect on the permeability of iron within certain limits, and that the same seems true of phosphorus; these are, however, said to be only general indications and not absolutely proved. The effect of carbon is discussed, as also of manganese and sulphur; manganese probably affects the magnetic properties through its effect on the carbon; its influence plays a very small part when the amount is below 1 per cent.; sulphur is also thought to have an effect through the carbon, but a very small quantity of it has a very decided effect; sulphur affects the permeability "through its power of promoting combined carbon." Silicon has a marked effect on the hysteresis, the loss by the latter being very much less when the silicon is high; it is thought that silicon has no direct effect on the permeability; it tends to hold the carbon in a graphitic state. Within the limit of somewhat over 1 per cent., it is thought that phosphorus has no effect on permeability or hysteresis. Carbon is undoubtedly the chief factor in the chemical effect on permeability and hysteresis. He thinks there is "some form of combined carbon that varied in irons high in combined carbon," and that the permeability was more affected by the percentage of this form of carbon than by the total amount of combined or graphitic carbon; this form of carbon has been called hardening carbon or martensite; it is thought that this is the state of the carbon which has most influence on the different varieties of iron in which permeability and hysteresis are important, but that statement is offered as a mere suggestion and is to be further investigated. The physical state of the metal seems to be more important than the chemical, in relation to its effects on the magnetic properties; an almost carbonless iron will often be found of low permeability and high hysteresis in comparison with its class, while after it is annealed it may give results very much better. Permanent magnetism or magnetic retentivity is discussed; manganese affects this power to the most marked degree; tabulated figures are given to show this. It is thought probable that a steel of moderate carbon and high manganese makes excellent magnets, while a high carbon steel with low manganese makes a rather poor magnet. He generally specifies the carbon between 0.50 and 0.56 per cent., manganese 0.70 to 0.80 per cent., sulphur not more than 0.05, phosphorus not more than 0.10 and silicon not more than 0.15 per cent.; such a steel gives very satisfactory results in practice for magnets. The ordinary contents of silicon usually found in magnet steel have practically no effect on magnetic retentivity. The higher the temperature at which the magnet is hardened the more magnetism it will have; with a moderate carbon and a high manganese steel, a higher hardening temperature can be used without great loss by breakage. Permeability seems to be a property of the iron itself, and is not notably affected by any of the metalloids usually associated with iron, other than carbon and manganese. He believes it to be legitimate to conclude that manganese in steel is in the combined form.—SUMMERS. Lond. *Elec. Eng.*, May 26.

Magnetic Decoherer.—Tommasina in the *Comptes Rendus*, May 15, describes an important discovery which he made, namely, that the presence of a magnet destroys the conductivity of the coherer if the latter is made of magnetic metals. In wireless telegraphy he therefore substitutes an electromagnet for the usual tapping device, the magnet being kept a few millimeters above the tube containing the filings. After the adjustments are completed, it is claimed that the coherer will work perfectly with tubes containing steel, iron, cobalt or nickel filings. This is said to improve the control of the action.—TOMMASINA. *Comptes Rendus*, May 15; noticed briefly in Lond. *Elec.*, June 2.

Acoustic Phenomenon in the Electric Arc.—Prof. Hartmann, in the *Elek. Zeit.*, May 25, gives the results of an investigation of the phenomenon described some time ago by Simon, and referred to in the Digest at that time; this was to the effect that the arc light may be used for converting acoustic into electric impulses and the reverse. The present writer thinks it probable that the sounds produced are due to the changes of volume of the arc corresponding to the varying number of carbon molecules which are vaporized. He also describes an additional phenomenon. The continuous current flowing through the arc is made to pass through the primary of an induction coil, the make and brake and the condenser having been removed; the carbons are best secured in a holder which keeps them in the same position, as distinguished from a lamp regulator; if then the arc is drawn out to its greatest possible length, a loud tone will

be heard all over the room, under the following conditions: When the terminals of the secondary are connected by a low or high resistance or by an apparatus like the coherer; or when either of the terminals are connected to earth, the other being insulated; or when they are both connected to the terminals of a condenser; or when one is touched with one hand and the other with the other hand; or when either alone is touched with the hand. The same effect, although less intense, can be produced without a secondary coil if the hands are clasped around the primary, or if a conducting shield is placed around that coil; the intensity of the sound increases with the number of windings. He believes this phenomenon explains the whistling and hissing of the arc, as all arc lamps contain coils in shunt to the main circuit (it is a fact, however, that an arc lamp with a plain hand regulator without any coils, will not hiss). The oscillations in the current are claimed to induce similar ones in the neighboring conductors which in turn have an induction effect on the primary currents, and he believes that the resistance usually placed in series with arc lamps and which generally has self-induction, not only regulates the energy delivered to the lamp, but may also diminish the noises.—HARTMANN. *Elek. Zeit.*, May 25.

ELECTRO-CHEMISTRY AND BATTERIES.

Chloride Works in Savoy.—Mr. Kershaw, in the *Eng. and Min. Jour.*, June 10, gives a well illustrated description of the works at Chedde, in France, where the Corbin process is used; the plant is near Chamounix, in the French Alps. The patents relate chiefly to the forms and details of the electrodes and vats. The factory has been in continuous operation since July, 1896, and has been producing the chlorate at the rate of 3000 tons per annum, in addition to calcium carbide. There are 12 continuous current Oerlikon dynamos, each directly coupled to a 1000-hp turbine. The electrodes are made of thin platinum foil held like a diaphragm in non-conducting frames. There are a series of these in each tank, and only the end electrodes are connected with the circuit; thus the intermediate electrodes act on both sides; the electrodes are only 12 to 15-mm apart. With a solution of potassium chloride, chlorine is liberated at the anode and potassium hydrate at the cathode, and these unite to produce potassium chlorate or potassium hypo-chlorate, according to the temperature at which the reaction occurs. No figures are given for the yield of chlorate per hp-hour nor for the cost of it by this process, as no data were obtainable; some estimates are, however, given for other processes, based on an output of 800 tons per year and a cost of 0.2 cents per electrical hp-hour. The capital expenditure is estimated to be $115,200, and the total working expenses $100,300. The efficiency of several chlorate processes is also given. The estimated figures show the cost to be 5.59 cents per pound; the selling price of the chlorate in the early part of last year in England was 6 cents per pound, thus leaving but a narrow percentage of profit.—KERSHAW. *Eng. and Min. Jour.*, June 10.

REFERENCES.

Storage of Electrical Energy.—An abstract of the article by Nansouty on the possibilities of the gas accumulator, which was duly noticed in the Digest at the time it was first published. Editorially the belief is expressed that this may soon be found to be the ideal device for the storage of electrical energy, which is free from the drawbacks of excessive weight.—*Eng. Mag.*, June.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Experiments with the Caldwell Interrupter.—Mr. Cooke, in the Lond. *Elec. Rev.*, June 2, describes some experiments with this form of interrupter which may help to explain the way in which the acid is drawn through the orifice. A large vessel filled with strong acid contained one electrode and a glass tube one-half inch in diameter, rapidly heats the anode, thus vaporizing the liquid around it, and dipping into this, and containing the other electrode; this tube had orifices of various size and shapes. When a current was passed the acid was drawn rapidly through the orifice and rose to a considerable height in the tube. The rise was not affected by the direction of the current and increased very rapidly with the voltage; some figures are given showing that for 130 volts and 4 amperes the rise was 90-cm. A 6-inch spark induction coil was in series with the interrupter. The orifice gradually increased in size, the edges appearing to be ground away and an irregular orifice became perfectly circular; the size of the orifice did not greatly affect the rise in the tube; by placing cones in the opening pointing first one way and then the other, it seemed that the acid would draw into the vessel which most obstructed its free flow from the orifice.—COOKE. Lond. *Elec. Rev.*, June 2.

Meter.—A brief illustrated description is given in the Lond. *Elec.*, May 26, of the Schattner meter, which is based on similar principles to that of the Long-Schattner prepayment meter, which was described some time ago. Its chief merit is its low price. The readings are not taken from dials, but depend on the adjustment of weights on a balance arm. It is an electrolytic meter in which copper is used, the cell being in a shunted circuit; the weight of the copper plate is balanced by sliding weights on a scale beam. One copper plate will last for about 1000-kw hours and must then be replaced at a cost of $1. The drop in volts for a 100-voltmeter is 0.7 at full load, while for a 200-volt circuit it is 1.4 volts. The copper sulphate solution has a specific gravity of 1.080 with 1 per cent. of sulphuric acid and 99 per cent. of water. It is stated to be correct within 2 per cent. at 1 to 10 amperes and within 4 per cent. at 0.15 ampere.—Lond. *Elec.*, May 26.

Measuring Capacities.—A description of a method of testing the dielectric constants of liquids and rarefied gases, based on a curious vacuum phenomenon. Some of the results obtained are as follows: They found that with long cylindrical vacuum tubes the luminous portion is longer the greater the capacity of the tube; the capacity of several tubes in series is not equal to the sum of their several capacities, but less and less as the number of tubes increases; this applies also to electroless tubes; the capacity is greater the lower the gaseous pressure.—BORDMANN and PETROVSKI. Comptes Rendus, May 8; noticed briefly in Lond. *Elec.*, May 26.

REFERENCES.

Meter Calculations.—Calculations to show how the rate of the Thomson-Houston meter will be affected if the temperature rise is 30° C.—Lond. *Elec. Eng.*, May 26.

Testing Meters.—A list of the different tests to be made before putting meters on the circuits.—Lond. *Elec. Eng.*, May 26.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Theory of the Marconi Telegraph.—A French Physical Society paper by Broca is briefly abstracted in the Lond. *Elec.*, May 26. It sems to refer to Blondel's theory of the vertical wires. According to the theory, the wire constitutes a centre of disturbance giving rise to circular magnetic lines of force propagated in planes perpendicular to the wire. With vertical wires the waves "slide" along the surface of the ground without being absorbed, as the lines of electric force are normal to that surface; but when the wires are horizontal, those force lines are parallel to the earth's surface; the ground acts like a mirror when the wires are vertical.—BROCA. Lond. *Elec.*, May 26.

German Telephone.—A description accompanied by a somewhat unsatisfactory illustration of this telephone is given in *L'Elec.*, May 20. It is a loud speaking telephone, the good qualities of which are said to be due to the microphone; it is said to enable cheap plants to be installed with iron wire and single line circuits. The chief feature of the microphone seems to be that instead of carbon he uses a semi-conductive material with which he is able to use very strong currents, as for instance those from 20 volts; this is claimed to be very high as the usual voltage is about 4; with these substances a strong current can be used without producing the usual crackling sounds.—DUMONT. *L'Elec.*, May 20.

A brief description accompanied by numerous illustrations from *La Nature* is given in the *Sc. Am. Sup.*, June 3.

REFERENCES.

Aetheric Telegraphy.—A reprint of a Society of Arts paper referring to his early experiments and to the present system of Marconi, in which the vertical wire is an essential feature.—PREECE. Lond. *Elec. Eng.*, May 12, and *Sc. Am. Sup.*, June 3. (In the original notice of this paper in the Digest, June 3, there was a typographical error which made it unintelligible.)

Single Line Block Signaling.—A brief illustrated description of the Sykes system for single line elctric railways.—Lond. *Elec. Rev.*, May 26.

MISCELLANEOUS.

Pressing Cloth by Electricity.—A brief report by Mouchel on the Chedville process is reprinted in the *Sc. Am. Sup.*, May 27. It is called the electrocalidor process, the boards for the presses being heated electrically. The results of the investigation of a special committee show the process to be a very satisfactory one. The current required for a press board measuring 1.09 yards by 27.5 inches is two amperes at 120 volts. An estimate is given of the coal required by this as well as by the old method of heating sheet iron plates in special ovens, and then placing them between the folds of the cloth. It is shown that there is an economy of fuel by the elec-

tric method. But besides this there are more important advantages, one of which is that the work may be more perfect, it being possible to regulate the heating mathematically. Those manufacturers who have used it have pronounced it a great improvement over the old method; another advantage is the extreme cleanliness. If an electric power plant already exists in the establishment, the expense of the process is reduced.—Atwell. *Sci. Am. Sup.*, May 27.

REFERENCES.

Catalogue of Scientific Literature.—The beginning of a report on the second conference on this international catalogue, the author being the American delegate.—Adler. *Science*, June 2.

Mechanical Engineers' Meeting.—A brief report of the 39th meeting of the Amer. Soc. of Mech. Eng., including brief abstracts of the papers, some of which are of indirect interest to electrical engineers.—*Amer. Mach.*, May 18.

Electrical Engineering in New South Wales.—Abstracts of the recent presidential address to the electrical association of New South Wales.—Webb. Lond. *Elec.*, May 26.

Exhibition in London.—An account of the electrical exhibits at the Surveyors' Exhiibtion.—*St. Ry. Jour.*, June, Int. Ed.

New Books.

The Manual of Statistics. Stock Exchange Hand-Book. Railroads, Street Railways, Industrial Securities. Grains and Provisions, Cotton, Petroleum, Mining, Banks and Trust Companies. Revised to Jan. 1, 1899. New York: Charles H. Nicoll, publisher. 580 pages. Price, $3.00.

This volume gives a brief history and financial statement of a number of railroads and industrial organizations. It is provided with a copious index.

BOOKS RECEIVED.

American Street Railway Investments. A supplement to the Street Railway Journal. Edition of 1899. Revised and corrected to June 1, 1899. New York: Street Railway Publishing Company. 294 pages, 34 maps. Price, $5.00.

The Riker Automobile Deal.

Note was made briefly in these pages last month of the important deal that has just been carried through looking to the rapid expansion of the Riker automobile interest. We are now able to confirm fully the exclusive information then given. Mr. Charles A. Lieb, of this city, when interviewed on the subject said:

"It is quite true that Mr. A. L. Riker, Mr. Oscar T. Crosby and myself have joined hands and that we shall push the Riker automobile business as it has never been pushed before, although as you are perfectly well aware, the Riker vehicles already stand foremost here and abroad. A large amount of new money will at once be invested. We have decided to locate at Elizabethport, N. J. The present Riker works are loaded with orders and are working night and day, while such carriage body builders as Flandrau's and Wood & Son's have heavy contracts also from us."

"Do you intend simply to manufacture for the market?"

"Broadly, yes, but we have large interests in the field of active use and may have even larger yet. Mr. Crosby and myself have large interests in light, power and traction at the National Capitol, and I am president of the Washington Automobile Company, which proposes to cut a figure in the development there of automobile business."

"How about your acquisition of the Great Fal's water power? Has that anything to do with this move on your part?"

"It has in a general way. We shall have at Great Falls a round 16,000-hp available, the bulk of which will be sent into Washington. But we also have 1200 acres of excellent building land, and it is not unlikely that some of our shops will be erected there. The climate is good for body building and painting and the native woods are excellent and abundant. Besides, with such cheap power, we can if we wish turn out Planté storage batteries very economically. One of the reasons for the prevalence of the Faure type has been the slow and expensive formation of the plate. At Great Falls, the facilities for cheap Planté production are illimitable. In addition we have direct railroad siding connection with the Baltimore & Ohio, Pennsylvania, and the Southern Railroads and are well situated for the receipt of raw material and despatch of finished products."

Mr. A. L. Riker when interviewed with regard to the changes now actually in process of being carried out said:

"This development of our facilities will enable me to carry out many ideas I have had in mind for some years as to automobile lines. It may not be generally known that I have been working on this subject for a long time. My first electric vehicle, a tricycle, dates back to 1884, and I built another in 1890. About 1895 I began to develop more modern types. One of my carriages won the first prize at the Rhode Island State Fair, Providence, at that time, and in 1898, at the competition of the Massachusetts Charitable Mechanics' Association in Charles River Park, Boston, I won one first and two second prizes, in the three events for which I entered, the Riker phaeton being the vehicle used. About June 1, last year, my first export vehicles were shipped to Paris, and since that time they have been at a high premium so great is the demand for them."

"Are there any special features in your work that make it distinctive?"

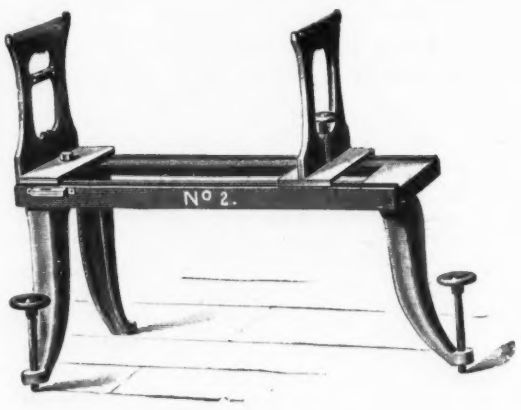
"I can only say that I have taken out a good many patents and I do not think I am wrong in imagining that some of them are fundamental in the automobile art as well as in other electrical branches. One feature I have emphasized is the detachment of the running gear from the body. My flexible running gear is so adapted to its purpose that, as the modern vehicles show, no decent automobile can be built without it. It is worth mention that I put out the first commercial delivery wagons in New York Ciy, and have supplied them now to such concerns here as Altman, the Gorham Company, to R. H. White & Co., in Boston, and to Kalb & Co., the big bakers in Philadelphia. I am now building a number of new types, and we are swamped with orders."

As to officers of the Riker Automobile Company, it is said that Mr. Riker will probably be general manager and engineer-in-chief. Mr. Lieb is well-known as an old manufacturer and inventor, while Mr. Crosby is one of the leading traction experts and engineers in this country.

The Riker Electric Vehicle Company has been formed under the laws of New Jersey with a capital of $2,000,000 non-cumulative preferred 6 per cent. stock and $5,000,000 common stock, both $50 par value per share. The present works at Elizabethport have a capacity of at least 5 carriages a day, and new machinery is being put in at once to add greatly to this. At an average of $2,000 apiece, this capacity alone represents an income of $3,000,000 a year, netting not less than 20 per cent., or say $600,000 per annum. The factory property embraces 49 acres and 500 men will be employed at once.

Balancing Way.

The tool illustrated herewith is useful in all constructing shops, particularly in electrical machine shops. It consists of a frame or bed on which are mounted two standards. One of these standards is fixed and the other is movable, the same as a tail block on a lathe.



BALANCING WAY.

The top edges of the standards are chilled and ground true and form the ways on which the work is rested while being tested or balanced. The frame is supported by three legs or feet, one of which is fixed and a little longer than the other two which are adjustable by means of the screws shown. A spirit level is secured to the fixed standard

and also one to the frame, so that both lateral and cross levels can be accurately determined. The Way is used in balancing all kinds of work, such as armatures, pulleys, cutter heads, etc., and is designed to supersede "horses" and similar devices generally used in machine shops for such purposes. It is portable and easily and quickly adjusted, and is giving satisfaction wherever it is used. It is manufactured by the N. P. Bowsher Company, South Bend, Ind.

Inclined Electric Elevator in a Philadelphia Store.

From time to time attention has been called in these columns to the new field of work opened up by the traveling sidewalk and the traveling stairway. Of the latter type of elevator we now have several examples operating in this country, all of them made under the patents of Mr. J. W. Reno, who, it will be remembered, put one in experimental operation at the Brooklyn Bridge entrance on the New York end, two or three years ago. Since that demonstration, Mr.

INCLINED ELECTRIC ELEVATOR.

Reno has carefully worked out details of the system of inclined elevator rendering it useful in stores, for the stairways of elevated railroad stations and for a variety of other places where it is desirable to avoid or minimize stair climbing.

In dry goods stores, the electrically driven stairway has many advantages. There is a limit to the space available for vertical elevators, and the capacity of such elevators is almost always found inadequate i the busy hours, so that customers struggle to get in and out. If, however, moving stairways for the one or two lower stories are installed, it is found that people will use them freely and that those floors at once become as valuable and accessible as the ground floor. This has been the experience in the cities where the inclined elevator stairways are now in operation, and the results are such as to suggest an early readjustment of rents, giving a higher value to floors not on the street level and which have hitherto been discriminated against because stairs had to be climbed. The cost of installation does not demand a very large amount of traffic to make the outlay profitable.

The latest instance of this work is the placing of a Reno inclined elevator in the big Wanamaker department store in Philadelphia. The novelty or peculiarity of this installation is that the "stair" is placed in the middle of the store, with the guiding handrail on both the right and left. In previous cases the stair has been put against the wall, even when traveling both ways, up and down, and it had been supposed that such a disposition was best. The inclined elevator at Wanamaker's, however, is right out in the middle of the floor away from all side walls, and operates just as well as though supported by a wall. The 5-hp C & C motor which drives the mechanism is encased with the traveling slats and rail, as indicated by the cut, the woodwork being polished oak. As many as 3000 persons per hour have been carried, and the number of customers on the second floor which is thus reached has been quadrupled. The cost for current is put at $1 per day.

It is interesting to note that five of these Reno inclined elevators are now under construction for the Paris Exposition of 1900, to give access to the galleries, and that this method of passenger transportation is to be one of the novel features of that great show.

Regulating Sockets.

The problem of regulating the light of an incande cent lamp has long received the attention of inventors. It is not difficult to dim the light by inserting resistance in series with the lamp, but such a method is wasteful of the current. The desired object is to regulate the intensity of the light and at the same time effect a corresponding change in current consumption.

A device for accomplishing this result is the McCay regulating socket, which is manufactured by the McCay Engineering Company, 106 East German Street, Baltimore, Md. The practical operation of these sockets was exemplified at the recent Electrical Exhibition at Madison Square Garden. In this exhibit, an illustration of which is given below, Mr. H. K. McCay had apparatus so arranged as to connect a wattmeter to any one of the eight lamps on the switchboard in order that the consumption of current at any degree of illumination might be noted The meter showed that the consumption when the lamp was at its lowest degree of illumination was only ten watts. This consumption is increased by regular gradations to the full amount required for 16-cp. By the use of this socket it is as easy to turn down the electric light as it is to turn down a gas light, and from the demonstrations at the exhibition, it was shown that there is a corresponding reduction in current consumption when the light is turned down. The advantages of having a regulating electric light are so obvious that they need not be mentioned here. Another advantages, besides ability to regulate the light and effect corresponding economy in current, is the increase of life of the lamp, which, it is claimed, is prolonged by reason of the gradual instead of sudden turning on and off of the current. The socket is designed for use on alternating current circuits, being made for 7200 and 16,000 alternations. The dimming action is due entirely to the use of a reactive coil contained within the socket.

Double-Pole Watch-Case Telephone Receiver.

The telephone receiver shown in the accompanying illustrations is well made and of simple construction. It is of the double-pole, watch-case type, and is manufactured by the Russell-Tomlinson Electric Company, of Shelton, Conn.

In a highly polished, nickel-plated case is placed a continuous, or

FIG. 1.—INTERIOR OF RECEIVER.

FIG. 2.—WATCH CASE RECEIVER.

EXHIBIT OF REGULATING SOCKETS.

ring magnet of the very best steel, from the centre of which is carried the poles. These are held in place by two strong screws that pass entirely through the hard fibre washer encircling the entire interior. The binding posts are driven into the fibre washer so that the tips of the receiver cord pass through the same from the outside of the case, and are held in place by set screws at the top of the posts. The magnets are powerful, and all minor parts are highly finished and durable, the steel poles being both copper and nickel plated to prevent rust.

NEWS OF THE WEEK.

Financial Intelligence.

COMMERCIAL CABLE COMPANY has declared a quarterly dividend of 1¾ per cent., payable July 1.

ELECTRIC VEHICLE COMPANY has declared a dividend of 2 per cent. on its common stock, payable July 1.

CHICAGO UNION TRACTION.—The organizers have called for payments on stock Monday, June 26. The call is for 100 per cent. of all subscriptions. This will yield $12,000,000, that amount of preferred stock having been underwritten at par.

AMERICAN BELL TELEPHONE COMPANY is inviting proposals to purchase $2,000,000 additional ten-year 4s, currency debentures, the same to close June 22, and the money to be paid July 1. These are part of an authorized issue of $10,000,000, of which $8,000,000 are outstanding.

CHICAGO EDISON.—At the annual meeting of stockholders of the Chicago Edison Company, it was voted to increase the capital stock from $5,000,000 to $6,000,000. It is said $500,000 of the new issue will be called for this fall and the other $500,000 next year. The stock will be issued to shareholders at par.

MASSACHUSETTS ELECTRIC COMPANIES.—The untaken balance of Massachusetts Electric Companies' stock, owning a large number of street railway properties, etc., will be offered to the public June 26. The underwriters have taken about half the issue, and shareholders of the constituent companies have applied for a large amount. Only a limited sum is expected to remain unsold by the 26th.

THE METAL MARKETS are still remarkably strong on the whole. Prices are still upward in iron and steel, and yet consumption continues very large. Heavy steel rail, Eastern mill, is quoted at $27. Copper has eased off, and closed the week around 18 cents. Some expert opinion considers it to be around high-water mark, as the price has been such as to tempt production from all manner of unusual sources.

WESTERN UNION has declared its regular quarterly dividend of 1¼ per cent. Its recent weakness seems due to a decrease of about $100,000 in net earnings for the period, but it is forgotten that this compares with the figures of the Spanish war outbreak, when the increased use of the telegraph was very large. The net revenue for the year is put at $5,850,000, interest and sinking fund at $897,000, and dividend at $4,867,944, leaving a surplus of $84,966.

A TRACTION TRUST.—Philadelphia has revived the story of a consolidation of the Union Traction Company of that city, the Consolidated Traction Company of Pittsburg, the Metropolitan Company of New York, and the recently consolidated Chicago traction lines—all Whitney-Widener-Elkins properties. These systems, according to the story, are to be sold to the American Railway Company, of which Mr. A. A .McLeod, of Reading fame, is the president.

THE NEW YORK GAS AND ELECTRIC LIGHT, HEAT AND POWER COMPANY'S 5 per cent. bonds, which were sold by subscription at 110½, immediately jumped to 112 on the curb last week. The $5,000,000 of these bonds that were offered were quickly taken up by investment interests, and they were not largely oversubscribed only because an oversubscription was not allowed. The lists were closed as soon as signatures for the $5,000,000 had been received, and consequently no apportionment was necessary. Banking houses seem to regard the issue as a decidedly attractive proposition at anything like present prices.

BALTIMORE, MD.—Alexander Brown & Sons and the Baltimore Trust & Guarantee Company of Baltimore offer at par and accrued interest, $3,232,000 first consolidated mortgage 4½ per cent. thirty-year gold bonds, and 14,000 shares 5 per cent. cumulative preferred stock at $40 per share and accrued dividend of the United Electric Light & Power Company of Baltimore, Md. This company is a consolidation of the Edison Electric Illuminating Company with the Brush Electric Company, and owns all the bonds and stock of the Northern Electric Company. For the year ending Dec. 31, 1898, the combined gross earnings were over $602,000.

NEW YORK ELECTRIC VEHICLE TRANSPORTATION was dull but fairly strong, and ended the week with a net gain of three-quarters of 1 point. It was reported, although not officially announced, that at the meeting of the directors of the Electric Vehicle Company, held June 12, it was determined to purchase a large block of the stock of the New York Electric Vehicle Transportation Company, which still remained in the treasury of that company. It is said that the amount of the New York Transportation Company's stock thus purchased was 60,000 shares, and that the Electric Vehicle Company paid for it at the rate of $10 per share, which is the amount thus far paid on the stock by the public.

METROPOLITAN STREET RAILWAY.—Talk of a "melon-cutting" among Metropolitan Street Railway stockholders is coming to be one of the foremost topics of Wall Street gossip. Directors and inside interests refuse positively to give any intimation of what is proposed; in fact, they will not say whether or not there is any proposition. Wall Street, however, has the point that the company's stockholders are to be given unexpected privileges or benefits before July 1. One story is that the dividend rate on the stock is to be raised to 8 per cent. per annum, and another tells that $5,000,000 of new stock issued for the purpose of carrying out the company's electric power and electric light plans is to be offered to stockholders at par.

RIKER ELECTRIC VEHICLE COMPANY.—The Riker Electric Vehicle Company has been incorporated under the laws of New Jersey, with a capital of $2,000,000 6 per cent. non-cumulative preferred stock and $5,000,000 common stock, par value of both $50. The company will purchase for cash all patents, machinery, contracts and rights of Andrew L. Riker and the Riker Electric Motor Company for the manufacture of electric vehicles. It will purchase also extensive works at Elizabethport, N. J., which have a present capacity of five completed vehicles per day. Among the interests connected with the company are Andrew L. Riker, Charles A. Lieb, president of the Great Falls Power Company of Washington; O. T. Crosby, president of the Washington Street Railways, and F. C. Stevens, president of the West End Bank, Washington.

WASHINGTON, D. C.—The United States Mortgage and Trust Company, Brown Brothers & Co. and Kountze Brothers offer for public subscription at par and accrued interest, $7,750,000 first mortgage collateral trust 4½ per cent. fifty-year gold bonds, due 1949, of the Washington Traction and Electric Company, which has acquired the Potomac Electric and United States Electric Companies of Washington, D. C., and the following street railway companies of that city: Metropolitan, Columbia, Anacostia, Georgetown, Brightwood, Forest Glen, Great Falls and Rockville. The electric companies are the only ones authorized to furnish electric lighting and power in the City of Washington, and the railroad companies own a total mileage of 116. Messrs. Vreeland and Pearson, of the Metropolitan road, speak highly of the earning capacity of the property. The total bond issue is $12,000,000, of which $4,250,000 has already been sold. The fixed charges will be $887,000 and earnings are put at $2,300,000 gross and $1,150,000 net.

LIGHTING DEAL ON LONG ISLAND.—A certificate of merger of the New York & Queens Light & Power Company, the Flushing Gas & Electric Light Company, and the Newtown Light & Power Company, with the New York & Queens Gas & Electric Company, was filed last week with the Secretary of State. The latter company was incorporated recently, with $1,000,000 capital. The Second Ward of Queens Borough is at present lighted by three companies. These are the New York & Queens Light & Power Company, the Flushing Gas & Electric Light Company, and the Newtown Light & Power Company. These companies are to be merged into one, and, it is said, the field of operations extended whenever it is possible to secure contracts outside of the present territory. The new corporation is known as the New York & Queens Gas & Electric Company. The Flushing Company is said to be at the back of the new company, and, although the name of one of the others is practically taken, the Flushing Company is understood to control it.

THE STATE OF TRADE.—Discussing trade conditions, Bradstreet's says: "Bank clearings are uniformly favorable as regards comparisons with last year, though naturally showing some shrinkage in volume as the month advances. For the week they aggregate $1,696,955,473, a decrease of 6.3 per cent. from last week, but a gain of 34 per cent. over this week a year ago, of 61 per cent. over 1897, and just double those of 1894, and 65 per cent. heavier than those of 1892. Business failures number only 150, against 178 last week, 207 in this week a year ago, 226 in 1897, 265 in 1896, and 231 in 1895. Advices as to distributive trade are in the main very favorable. Hot weather has stimulated retail business, and orders for fall delivery are reported in larger volume and earlier than for years past. At some centers, in fact, less than the usual effect is looked for from seasonable midsummer influences. This is, however, best illustrated in the iron and steel trade, which displays unexampled activity as regards summer production and consumption, limited only by the obtaining of supplies."

THE WEEK IN STOCKS.—Wall Street has reached a season of summer dulness and seesawing, and there is little activity in any line. During the past week 6556 shares of Western Union were sold, rising from 88¾ to 90⅜. Of General Electric, 1800 shares exchanged hands, easing off to 117½. Brooklyn Rapid Transit sold to the extent of 266,267 shares, closing stronger at 117½. Metropolitan Street Railway on sales of 48,245 shares was stronger also at 226, and Manhattan Elevated on 120,335 shares was weaker, closing around 112¼. In Boston, American Bell Telephone was steady around 340. In Chicago, North Chicago Railway was quoted at 245, West Chicago at 120, and South Side Elevated at 95, National Carbon common at 18, and preferred at 81. Outside securities in New York were dull. Electric Vehicle common was bid at 106, and preferred at 118. Electric Boat was bid at 20 common and 45 preferred. General Electric Automobile was 17 bid and 24 asked; General Carriage Company, 36 bid and 37 asked; New York Electric Transportation was 22 bid and New England 12⅝.

HUDSON RIVER TELEPHONE.—There has been considerable trading in Hudson River Telephone rights, by the purchase of which it is possible to obtain the new stock at desirable concession from the market prices now ruling. Stockholders have the privilege of subscribing for one share of new stock at par for every fourteen shares of stock held, or they may assign their rights. Messrs. Spencer, Trask & Co., who are dealing largely in the rights, furnish the following illustration of the basis on which the new stock may be obtained through purchase of the rights at say 20 cents per share, at which figure they are offered. Rights on 14 shares at 20 cents, $2.80; subscription to 1 share at par, $100. Total cost 1 share new stock, $102.80, or about 2 per cent. below the present market price for the stock. Hudson River Telephone stock is constantly increasing in favor not only among local investors, but also in Boston and other Eastern cities where the stock is largely held. The business of the company is being rapidly extended, and its earnings show handsome increases. The stock is practically on a 5 per cent. basis, so that at present prices it pays the investor better than almost any other local security. The company has no bonded debt.

Special Correspondence.

NEW ENGLAND NOTES.

MR. NORMAN WILLIAMS, father-in-law of General Wesley Merritt, died at Hampton, N. H., on June 19, aged 65. He was a leading Illinois lawyer, and a director in the Western Electric Company, the Chicago Telephone Company, and the Pullman Car Company.

ELECTRO-PNEUMATIC INTERLOCKING SYSTEM.—What is said to be the largest and most intricate railway switch and signal plant in the world is that at the Boston Terminal Station. It is operated on the pneumatic, auto-electric system, and was tested recently, working in a satisfactory manner. This plant was described and illustrated in THE ELECTRICAL WORLD AND ENGINEER of March 11, 1899.

AUTOMOBILE CLUB.—A movement has been inaugurated in this city to organize a club to include all the motor wagon enthusiasts in the city, as well as a number of those whose business or study of automobiles has given them a technical and expert knowledge of the new industry. The plan is that the club shall have monthly meetings and that at each meeting there shall be one or more papers read dealing with the building or use of automobile vehicles, followed by a general discussion of the topics suggested by the papers. The meetings will take place at one of the hotels. Among the promoters are Messrs. J. Hector Graham and W. B. Weston, of the Graham Equipment Company. A preliminary meeting will be held in a few days. A set of by-laws has already been prepared in which the object of the organization is stated to be, first, the promotion of knowledge on all matters pertaining to the construction and management of self-propelled vehicles, and any improvements which may be brought before the club for consideration and discussion, and, second, to encourage social relations among its members.

TELEPHONE SUIT.—The suit of the Western Union Telegraph Company, et al. vs. the American Bell Telephone Company, which is now of 16 years' standing, was, on June 13, brought up before Judge Colt in the United States Circuit Court, Boston, for final hearing. The parties to the controversy, which was begun on Nov. 16, 1883, are the Western Union Telegraph Company, the American Speaking Telephone Company, the Gold & Stock Telegraph Company and the Harmonic Telegraph Company, corporations of New York, the plaintiffs, and the American Bell Telephone Company, a Massachusetts corporation, which is the defendant. The litigation grows out of a contract made on Nov. 10, 1879, by the Western Union Telegraph Company and the National Bell Telephone Company, of which the defendant is the successor. This contract, it is alleged, gave the general conduct of the telephone business, which the plaintiffs were then engaged in, to the defendant for certain "rentals or royalties." The Hon. George S. Hale was counsel for the plaintiff, and former Judge E. R. Hoar, William G. Russell and James J. Storrow appeared for the defendant. Former Judge John Lowell, the master who heard the case, has rendered to the court an account of his stewardship. The case now awaits a final decision.

NEW YORK NOTES.

UNITED ELECTRIC LIGHT & POWER COMPANY, of New York city, well-known as a Westinghouse property, has, after many reports on the subject, apparently changed hands. The Consolidated Gas Company is reputed to be the new owner. Messrs. Westinghouse, Cravath, Hebard, Jackson and Kobbe remain directors, and among the new members of the board is Mr. A. M. Young.

SOUNDINGS FOR THE NEW GERMAN CABLE.—The British Cable Steamship Britannia arrived in New York harbor a few days ago from the Azores, after completing her work of taking soundings for the new German cable which is to be laid between New York and Emden. A syndicate of German capitalists, the Land & Sea Cable Company of Cologne, and the Commercial Cable Company of this city, will build and own the line, which will cost about $5,000,000. The new cable will run from Emden to Fayal, Azores, and thence to Coney Island. The distance from Fayal to this port is 2,279 miles. Mr. George G. Ward, vice-president and general manager of the Commercial Cable Company, is now in Europe in consultation with German capitalists interested in the enterprise.

INDIANA NOTES.

TO VOTE ON AN ELECTRIC LIGHT FRANCHISE.—The City Council of Seymour, Ind., has decided to submit the question of an electric light franchise to the people under the provisions of the new law.

OFFER OF FREE TELEPHONE SERVICE.—Superintendent Vail, of the Central Union Company, has offered the city of Indianapolis telephone service free to all municipal departments for the rest of the year, provided the city pay the accumulated bills of $1903.

AUTOMOBILE EXPRESS WAGONS.—President Moran, of the Indianapolis Transfer Company, has arranged with the Automobile Syndicate, of New York, for a number of horseless vehicles to do the business of that company. The number employed the first year will be 20. They will be much lighter than those in use in Indianapolis at present.

A RAILWAY PROJECT UNDER CONSIDERATION.—Another electric railway project is under consideration at Indianapolis, relating to interurban lines exclusively. The proposed organization is to be known as the Indiana Traction Company, and will have a capital of $4,000,000. The purpose of the proposed company will be to control all the interurban lines running out of Indianapolis, and will operate over the lines of the Indianapolis Street Railway Company. A number of capitalists interested were in conference with the local men on June 7, and a thorough discussion of plans and ideas was had. The articles of incorporation were carefully gone over. The heavy stockholders of the Indianapolis Street Railway Company, who live in the East, were represented and interested in the scheme. The proceedings have been kept from the public, but the following lines are included in the deal: The Henry or Anderson line, the Plainfield, the Logansport, the Greenfield, the Martinsville and the Mooresville lines. Indications point to the conclusion that quite all, if not all, the interurban lines centering in Indianapolis will soon be under one management.

PHILADELPHIA NOTE.

WATER POWER ELECTRIC PLANTS.—Mr. B. C. Washington, Jr., on the evening of June 13, read a paper before the Electrical Section of Franklin Institute, entitled "Water Power Electric Plants of the United States." He began by giving an historical resumé of the application of water power for operating machinery and its rather recent application for driving dynamos. He also referred to the development of water wheels, from the crude devices of the ancients to those of the present time which have attained a high degree of efficiency. Methods for determining what water powers should be developed were explained at length and the advantages of electric transmission of power were fully exploited. The conditions which regulate the use of different styles of water wheels and the proper means of connecting them to the generators were also treated. Mention was made also of water wheel governors and their value for regulating where there are variable loads on the generator. After a few remarks relative to insulators and transmission lines he took up the description of such transmission plants as the Folsom-Sacramento, the Newcastle-Sacramento, the Telluride-Mercur and the Mechanicville-Schenectady. He followed with short descriptions of a large number of other transmission plants as an illustration of the various applications of electricity for mechanical purposes. The subject was fully covered and profusely illustrated by lantern slides. Mr. Washington stated that there are nearly 500 water power electric plants in the United States, representing an aggregate investment of over $600,000,000, and the total horse-power represented by water wheels in these plants furnish current for 28,000 arc lamps, 60,000-hp of motors used for manufacturing, mining and other purposes, and, besides this, supplying current for the motors on the cars operated on 610 miles of electric railways.

PITTSBURG NOTES.

DEATH OF MR. BURNS.—Mr. W. J. Burns, president and general manager of the West End Traction Company, and one of the first men in this city to interest himself in the introduction of electric railroads in Pittsburg, died a few days ago in Paris, France.

A WESTINGHOUSE SUIT.—The Westinghouse Electric and Manufacturing Company has filed a bill in equity in the United States Circuit Court of this city against Weyman & Bros., alleging an infringement of certain improvements in dynamo-electric machines.

PROF. REGINALD A. FESSENDEN, in charge of the electrical engineering department of the Western University of Pennsylvania, has discovered a means of making the flash of the smokeless powder visible. The discovery is yet a secret, but Prof. Fessenden is negotiating with Secretary Alger of the War Department, with a view of selling the secret to the Government.

CONSOLIDATION OF LIGHT AND POWER INTERESTS.—All electric light and power-supplying corporations in the eastern part of Allegheny County have been consolidated under the name of the Monongahela Light & Power Company. The companies in this combination are: The Wilkinsburg Electric Company, the Citizens' Electric Light Company of Braddock, the Turtle Creek Valley Electric Company of East Pittsburg, the Turtle Creek, Wilmerding & Pitcairn; the McKeesport Light Company of McKeesport, the Duquesne Heat, Light & Power Company of Duquesne, and the Homestead Electric Light & Power Company of Homestead. Mr. A. W. Mellon, the well-known Pittsburg banker, is president of the consolidated companies. The new concern will concentrate its operations in a new central station, which is now in process of construction.

CHICAGO NOTES.

THE CONSTRUCTION DEPARTMENT of the Western Electric Company has secured the contract for wiring 5000 lights in the Williamson Building, Chicago.

MR. F. N. JEWETT has opened an office at 1120 Monadnock Building, Chicago, for Evans, Almirall & Co., of 44 Dey Street, New York, to handle the Evans system of exhaust hot water heating for central stations and factories.

AUTOMOBILES EXCLUDED FROM THE PARKS.—On the initiative of Park Commissioner Sherman an order has been issued directing the police to exclude all automobiles from the park driveways. The new regulation will go into effect at once. To test the ordinance Messrs. H. E. Osborn and C. E. Woods, the well-known automobilists deliberately violated the order on June 19, and were arrested. The matter can now be carried to the courts as a test case.

STREET RAILWAY SCHEDULES.—The City Council Judiciary Committee decided at a recent meeting that the running schedule for street cars on the downtown routes shall be regulated by the city, and if the cars are not run according to these schedules mandamus proceedings will be begun against the railway company. A committee was appointed to co-operate with the corporation counsel in framing an ordinance.

INDEPENDENT TELEPHONY IN CHICAGO.—Negotiations have been completed by which the Illinois Telephone & Telegraph Company enters into a contract with the Strowger Automatic Telephone Company for the use of the latter's system of underground wires, automatic switchboards and complete transmitting apparatus. The Strowger Company will proceed with the work of obtaining subscribers which appears to be a part of the contract entered into. As soon as the system is installed no charge will be made for

service until such time as there are 10,000 subscribers to the new company. It is stated that the first exchange will be in operation within one year. The contract calls for a system of 30,000 drops.

MILWAUKEE NOTES.

MR. OTTO J. WALLHER is continuing the business formerly carried on by Peterman & Wallher. The firm recently dissolved partnership.

MUNICIPAL LIGHT FOR ELROY, WIS.—At the special election at Elroy, Wis., the vote was 4 to 1 in favor of bonding the city for an electric light plant.

THE FALK MANUFACTURING COMPANY'S plant was totally destroyed by fire a few days ago. The company is well known as an electric railroad contractor and rail joint contractor. It was doing a rushing business, having large contracts in many parts of the country. Its loss is severe on this account.

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY has extended its Wauwatosa line a mile and a half beyond Wauwatosa to the county institutions. The company has just completed relaying rails on Grand Avenue. The construction of this track is worthy of mention. Heavy T-rails were laid on a crushed stone and concrete foundation and all joints were welded by the Milwaukee Rail Joint & Welding Company. The railway company is endeavoring to interest the city of Milwaukee in an electric fountain for one of the parks. The company offers to stand the expense of the electric features of the fountain if the city will meet the expenses of the building and maintenance. It is estimated that a suitable fountain would cost about $25,000.

ST. LOUIS NOTES.

SUBURBAN'S LOOP IN OPERATION.—The downtown loop of the St. Louis & Suburban Railway Company is now in operation.

FARES REDUCED.—The Suburban Railway Company has reduced the fare from Florissant to 25 cents. Formerly residents of that town were compelled to pay 50 cents. The fare to and from Florissant all along the line has been reduced to one-half.

LIGHT AND WATER CONTRACT LET.—The City Council of Louisville, Ill., on June 8, voted to contract with Messrs. Reed & Surrels, of Chicago, to put in an electric light and waterworks plant for that city, the same to cost $10,500. The work will be commenced within thirty days, and is to be completed within 100 days.

A NEW STREET RAILWAY LAW.—The Drabelle street railway law, passed by both houses and approved by the Governor, April 27, 1899, is one of the most important pieces of legislation, so far as St. Louis is concerned, that has been enacted for many years. The effect of it will be to prevent the location of street railways hereafter except upon the petition of a majority of the owners of property along the line where it is projected. It is substantially the same law that has been in force in Illinois since 1874, and also in New York and Ohio.

TO EXAMINE THE MOTORMEN.—The Municipal Assembly will in the near future be asked to pass a law which, it is stated, will protect citizens much more than any fender or combination of fenders on street cars. The provisions are that motormen, like engineers, must be licensed. An examination as to their fitness must be made before a board appointed by the Mayor and confirmed by the Council. This is to determine the applicant's sense of sight and hearing, his quickness of action, knowledge of speeds and of electricity. Conductors must pass the same examination, and will be held responsible for the conduct of their cars. The examination must be repeated at regular intervals.

TEXAS AND MEXICO NOTES.

THE ELECTRIC LIGHT PLANT at Lockhart, Texas, has been equipped with new machinery and otherwise improved. This plant suffered serious damage recently from an electric storm.

THE SAN ANTONIO (TEXAS) STREET RAILWAY COMPANY has just completed extensive and costly improvements of its properties. About five miles of track which the company purchased from the Edison Street Railway Company a shor ttime ago has been relaid and the gauge reduced to conform to the system of the purchasing company. The consolidated system now extends to all parts of the city and to the several suburbs.

TO IMPROVE CHIHUAHUA'S STREET RAILWAY.—A new company has been formed to equip and manage the street railway system of Chihuahua, Mexico. The reorganized company has a capital of $200,000. Mr. J. C. Earley, representing the new organization, has been sent to the United States to purchase new rails, cars and other equipment. The rails will be 50-pound, and the cars of the latest improved design. The lines of the company are to be extended so as to form a belt system, connecting with all of the railroad depots and the principal manufacturing concerns of Chihuahua. The officers of the new company are as follows: Governor Ahumada, president; Enrique C. Creel, treasurer; Lorenzo Arriolli, secretary; Julio Meyer and F. Sismega, directors. Carlos Nieto has been elected superintendent.

DROUTH FOLLOWED BY FLOOD.—The municipal electric light, power and water works plant, of Austin, Texas, which a few weeks ago suffered heavy loss on account of protracted drouth, has been experiencing the other extreme for the past ten days, in the nature of one of the greatest floods in the history of the Colorado River. The plant in question derives its power from Lake McDonald, which is formed by a gigantic dam across the Colorado. The rise in the river came down suddenly and within a few hours the waters of the lake had risen to a height of 10 feet over the crest of the dam. A rise of 5 more feet would have flooded the power house. The great torrent of water has been pouring over the masonry work of the dam for the past several days, and it is feared that the foundations of the large power house have been impaired by the constant churning of the flood at its base. The water furnished by the plant is so full of mud as to make it totally unfit for domestic use. The flood swept away many miles of telephone and telegraph wires. The work of repairing the numerous breaks is being carried on rapidly.

PACIFIC COAST NOTES.

THE SAN FRANCISCO & SAN MATEO RAILWAY COMPANY recently closed a contract with John Hammond for thirty 28-foot electric cars, which will be needed when the extensions of the road are completed.

HOSPITAL LIGHTING.—The Mutual Electric Light Company, San Francisco, has, by its enterprise, secured a very desirable contract for lighting the new General Hospital for the United States soldiers at the Presidio, which will be completed next month. There are 19 buildings in all.

THE CLEAR LAKE ELECTRIC LIGHT & POWER COMPANY was recently granted a 50-year franchise by the supervisors in Santa Rosa, Cal. A franchise has been granted to the company in Napa County, and the engineering difficulties which have long prevented the development of the water power may soon be overcome.

LARGE ELECTRICAL PLANT.—The Westinghouse Electric & Manufacturing Company has been given a further contract by the San Gabriel Electric Company, Azusa, Cal., for an additional rotary converter of 550-hp. This unique plant, generating electricity by water power and transmitting it at 16,500 volts, is gradually supplying current to the entire neighborhood. The new machine is employed to supply electric current to the street railroads of Los Angeles. The San Gabriel plant now consists of one 325-hp, two 300-hp and two 550-hp rotary converters. As new users of electric power are found the machinery is expanded to meet the demand.

CANADIAN NOTES.

THE CITY OF WINNIPEG, Manitoba, has purchased two 100-light Western Electric arc machines, and 220 Western Electric open arc lamps.

THE CANADIAN ELECTRO-CHEMICAL COMPANY has made application for incorporation, with a capital stock of $1,000,000. Its headquarters will be at Sault Ste. Marie, Ont. The company will develop and mine gold, silver, copper, nickel, iron and other mineral deposits, and smelt, reduce and refine all kinds of minerals. The applicants for incorporation are F. H. Clergue, Philadelphia; E. V. Clergue, New York; B. J. Clergue, Sault Ste. Marie, Ont.; H. C. Hamilton and Nelson Simpson, of the same place.

THE HOEPFNER REFINING COMPANY, of Hamilton, Ont., has applied for a charter. The capital stock is fixed at $600,000, and the objects of the company are the mining and refining of zinc, lead, silver, nickel and copper ores. The company will control the Canadian patents of Mr. Carl Hoepfner, whose process for the refining of ores is said to be much cheaper and generally better than any other in use. Electric current will be supplied to the company by the Cataract Power Company, which is already furnishing electric light and power in Hamilton. The names of the incorporators of the new company are Carl Hoepfner, Frankfort-on-the-Main; A. T. Wood, Hamilton; David Maclaren, Ottawa; N. Dyment, Barrie; Hon. J. M. Gibson, John Moodie and John Patterson, Hamilton; Henry Necarsulmer and Albert F. Fuerst, New York.

General News.

THE TELEGRAPH AND TELEPHONE.

PELLA, IOWA.—A franchise has been granted for a local telephone system.

GLADBROOK, IOWA.—A telephone exchange is to be established in this place.

ROCHESTER, MICH.—A telephone system is to be established at Arbor Beach.

OHIO, ILL.—The Ohio Telephone Company has increased its capital stock from $800 to $5000.

DOVER, ILL.—The Dover Telephone Company has increased its capital stock form $2000 to $50,000.

CLEAR LAKE, IOWA.—The Clear Lake Independent Telephone Company has been organized, with a capital stock of $2000.

GOLCONDA, ILL.—The Pope County Telephone Company has been organized here with a capital stock of $5160, by E. B. Clark, W. H. Moore, and J. O. Williamson.

PASS CHRISTIAN, MISS.—The Town Council has granted a franchise to the Cumberland Telegraph & Telephone Company to establish and operate a telephone system in this place.

ALBANY, N. Y.—The Twin City Telephone Company has been incorporated, with a capital stock of $40,000, by J. H. Barnard, C. I. Watson, W. A. Carder, of North Tonawanda, and G. A. Curren, of Buffalo.

LANSING, MICH.—A bill has passed the Michigan House of Representatives taxing telegraph and telephone companies 2 per cent. of their gross earnings; another bill passed taxes corporate property on its cash value.

CHEYENE, WYO.—The Rocky Mountain Bell Telephone Company is making preparations to construct a line between this city and Greeley or Fort Collins. This line will connect with the long-distance service at Denver.

CHATSWORTH, ILL.—The Peoria & Eastern Automatic Telephone Company has been organized in this place with a capital stock of $12,000. The incorporators are F. C. Stanford, Joseph E. Heald and G. W. McCabe.

BALTIMORE, MD.—The Maryland Telephone Company has been permanently organized by Mr. George R. Webb as president; Mr. Harry A. Parr, vice-president; Mr. Pinckney W. Wilkinson, secretary; Mr. William H. Emery, treasurer.

CLATONIA, N. Y.—The Clatonia Telephone Company has been organized to do a general telephone business. Its capital stock is $5000, and the incorporators are S. Borkey, F. W. Jones, J. H. Steinmeyer, H. H. Jones and H. Albert, all of Clatonia.

BOSTON, MASS.—At the annual meeting of the stockholders of the Erie Telegraph & Telephone Company, the following named gentlemen were elected to the board of directors: J. C. Burke, Lowell; A. B. Chandler, New York, and David S. Greenough, Boston.

STEUBENVILLE, OHIO.—The lines of the Phoenix Telephone Company and the Farmers' Independent Telephone Company have been connected at Wintersville. The Farmers Company has about twenty telephones. The line is now being built west to Bloomfield.

LOUISVILLE, KY.—The Cumberland Telegraph & Telephone Company has purchased the building lately occupied by the Ohio Valley Telephone Company, paying therefor $100,000. The Ohio Valley Telephone Company was recently purchased by the Cumberland Company.

PERTH AMBOY, N. J.—The Amboy Telephone Company has been incorporated to build and operate a telephone system. The capital stock is $10,000, and the directors are Andrew Bingler, Jersey City; Richard S. Bowen, Harrison, N. J.; Samuel A. Boyd, Brooklyn, N. Y.

WHEELING, W. VA.—The National Telephone Company has been organized in this city to maintain and manage telegraph and telephone exchanges. The capital stock is $150,000. The incorporators are A. G. Steelman, I. H. Shirk, H. M. Buck, J. B. H. Jefferson, E. L. Ward, all of Baltimore, Md.

WALTHAM, MASS.—The Waltham Board of Aldermen has granted a franchise to the Massachusetts Telephone Company to establish a system in this city. The company will furnish the city with telephones for city use free of charge, and the service rate for business purposes will not exceed $3.50 per month.

COLUMBUS, OHIO.—The final contract and ordinance awarding a franchise to the Columbus Citizens' Telephone Company have been unanimously approved by the Board of Public Works and passed by the City Council. The company will likely begin work within 30 days, and its exchange will be in operation by the first of next year.

ALBANY, N. Y.—The Delaware Valley Telephone Company has been incorporated, with a capital stock of $25,000. The points to be connected by the company's system are North Sanford, Binghamton, Afton, Bainbridge and Masonville, and the principal places in Broome, Chenango and Delaware Counties, N. Y., and Susquehanna and Sherman, Pa. The incorporators are E. A. Goodsell, Afton; V. E. Grégory, North Sandford; L. Bilby, Deposit.

HARRISBURG, PA.—The Southern Telephone Company has applied for a franchise to build a line in this city. It promises a first class service at about one-half the rates charged at present by the Pennsylvania Telephone Company. The latter company is opposing the plans of the new company and it is likely that a local telephone war will be precipitated. The Pennsylvania Company recently made a reduction in its rates, but not enough to please many of the patrons who hear so much of cheaper service elsewhere.

ELECTRIC LIGHT AND POWER.

PERKASIE, PA.—At a special election recently held here a large majority of the votes were cast in favor of bonding the town for $15,000 for an electric light plant.

MILWAUKEE, WIS.—It is reported that the Badger electric light plant in Racine, Wis., has been sold to the Milwaukee Electric Light & Power Company.

LOVELAND, COLO.—Mr. Ray Smith, of Longmont, has been granted the privilege of erecting electric light poles and stringing wires in the streets of this place. Mr. Smith expects to have the plant in operation by Oct. 1.

MARION, IND.—Mr. Fred G. Wilson has been appointed receiver of Keller & Mead's electric light plant. This action is the result of a refusal of Keller & Mead to accept $48,000 alleged to have been agreed upon for the sale of the property.

CONCORD, N. H.—The Marlborough Electric Light, Heat & Power Company, of Marlborough, has been incorporated, with a capital stock of $5000. The incorporators are E. B. Knowlton, C. Hodgkins, C. O. Whitney and J. H. Kimball.

ROGERSVILLE, TENN.—The Rogersville Electric Company has been organized, with a capital stock of $5000, to carry on an electric light and power business. The incorporators are C. C. Cochran, A. B. Rogan, S. Webster, J. T. Anderson, A. D. Huffmarter and R. H. Spray, all of Rogersville.

ALBANY, N. Y.—The Hudson Light & Power Company has changed its name to the Hudson Light, Power & Railway Company. The amended certificate of incorporation gives the company the right to operate the Hudson street railway, which property has been transferred to the Hudson Light & Power Company.

THE ELECTRIC RAILWAY.

SOUTH HAVEN, MICH.—The City Council has granted a franchise for the proposed electric railway from South Haven to Saugatuck.

HARRISBURG, PA.—A charter has been issued to the Springfield Street Railway Company, of Delaware County, which will connect existing lines.

ROCHESTER, N. Y.—The Rochester Railway Company has just completed the installation of an automatic block signal system on the Charlotte branch.

BOSTON, MASS.—The Waltham, Ayer & Pepperell Street Railway Company has been incorporated. It is said to be the longest line thus far formed in this commonwealth.

BRIDGETON, N. J.—The Pridgeton & Millville Traction Company's road has been sold to a Philadelphia syndicate, which has also purchased the Bridgeton electric light plant.

ATLANTA, GA.—The Collins Park & Belt Electric Railway Company has asked for a franchise to build an electric railway system in this city. The capital that will be spent in building the lines and making contemplated extensions and improvements will reach $2,000,000.

LANSING, MICH.—The Detroit & Lake Orion Electric Railway Company has filed articles of incorporation changing the name of the company to the Detroit, Rochester, Romeo & Lake Orion Railway Company, and increasing the capital stock from $300,000 to $500,000.

MANKATO, MINN.—The Mankato Electric Street Railway, Lighting & Power Company has purchased the plant of the American Linseed Oil Company, in this city, and will use it as the location of its power plant. Work on the plans and specifications of the plant is now under way.

COLUMBUS, WIS.—Mr. C. D. Smith, of Fond du Lac, has asked for a 40-year franchise to construct and operate an electric railway between Fond du Lac, Waupun, Beaver Dam and Columbus, the privilege to include commercial lighting. The matter will be considered at the next meeting of the council.

NORFOLK, VA.—A charter has been granted to the Washington Traction & Electric Company, whose authorized capital is $12,000,000. The officers of the company are Samuel B. Lawrence, president; Henry M. Haviland, vice-president; George D. Spencer, treasurer; John Summerfield, secretary, all of New York.

GRAFTON, MASS.—Mr. Louis B. Wheildon, president of the proposed Grafton, Upton & Milford Street Railway Company, has purchased a majority of the stock of the Grafton & Upton Railway and practically secured control of the same. It has been decided to equip the road with electric power for the passenger service.

LITTLE FALLS, N. Y.—Mr. Charles Sullivan has been appointed receiver of the Little Falls & Dolgeville Railway Company and the road between the two places is now operated by him. The appointment was made on the application of the Manhattan Life Insurance Company, which holds the second mortgage bonds.

MILWAUKEE, WIS.—The Milwaukee Traffic & Terminal Railway Company has applied to the Common Council for a franchise to build a belt electric railway around the city. It is stated that Chicago and Milwaukee capitalists are at the back of the enterprise and will spend $3,000,000 to complete the project within two years.

BOSTON, MASS.—The Lexington & Boston Street Railway Company has secured the franchise from Billerica. The proposed line will connect there with the Lowell & Suburban line to Arlington and with the Boston elevated at the latter place. This will give rapid transit from Lowell to Boston. The corporation has franchises from Lexington and Waltham.

NEW YORK, N. Y.—The Brooklyn Rapid Transit Company is considering the question of increasing the wages of motormen, conductors and other employees. This action, it is stated, is the result of the steady increase in the company's earnings. The receipts of the company for the first 11 days of June were $51,000 more than those of the corresponding period last year.

OSWEGO, N. Y.—The Oswego Street Railway Company and Lake Ontario & Riverside Railway Company have been reorganized under the name of the Oswego Traction Company. The capital stock is $300,000 and the directors are S. M. Coon, D. B. Page, Charles A. Tanner, R. Arthur Downey, James P. Doyle, W. S. Bentley, Daniel A. Williams and Max B. Richardson, Oswego; George I. Turnbull and Charles C. Crook, New York City; C. Sidney Shepard, New Haven.

SILVER SPRINGS, N. Y.—The Perry, Castile, Silver Springs & Pike Railway Company has been organized in this place to operate an electric railway in Wyoming County, thence through the towns of Pike, Genesee Falls, Gainesville, Castile, Perry and Silver Springs. The capital stock is $200,000, and the directors are John H. and J. M. Duncan, C. S. Van Gorder, Albert O. Skiff, Frederick H. Lyon, Henry O. Brown, Milo H. Olin, J. Clarence Lullibridge, G. M. Maher, M. N. Cole and J. H. Van Arsdale.

NEWARK, N. J.—The franchise and plant of the New Jersey Electric Railway was sold at auction at Secaucus a few days ago, for $1,500,000. It is understood that the purchase was made in behalf of those in control of the North Jersey Street Railway Company, and that the road will be included in the North Jersey system. The New Jersey Electric Railway Company owns the Paterson, Passaic & Rutherford, the Rutherford & Jersey City and the Paterson & Little Falls lines. The company has been in the hands of a receiver for about a year.

BRIDGEPORT, CONN.—It is reported that negotiations are on foot for the consolidation of a large number of the street railways of the southern and central part of the state. The purchasing company is to be the Connecticut Lighting & Power Company, which has already obtained a special charter with almost unlimited powers of purchase and stock and bond issue. Mr. A. M. Young, of Waterbury, and A. M. Page, of Bridgeport, and a syndicate of New York capitalists are to finance the company. Among the companies which are reported as being sought after are the Central Railway & Electric Com-

pany, of New Britain, Norwalk Street Railway Company, Waterbury Traction Company, Norwalk Tramway, Bridgeport Traction Company, Westport & Saugatuck, Winchester Avenue Road, Derby Street Railroad Company, Bristol & Plainville and the Shelton Street Railway Company. The plan is said to be to purchase all the electric railway properties mentioned above, construct extensions where needed, so that a through line from Waterbury to New Haven and from New Haven to Stamford may be put into operation, and when that has been done to issue new stock for the combined companies and bond the consolidation to a figure that will pay for building the extensions. The bonds are not to be above 4 per cent., and for a short term.

LEGAL.

HATCH STORAGE BATTERY LITIGATION.—On June 14, 1899, Judge Colt, in the United States Circuit Court, at Boston, Mass., granted a preliminary injunction on complaint of the Electric Storage Battery Company, of Philadelphia, Pa., against the Quincy & Boston Street Railway Company, restraining the latter from using and operating the elements of the Hatch storage battery installed at South Braintree, Mass., and employed as an auxiliary to the trolley system. It is held that the Hatch battery infringes upon the Brush patents owned by the Electric Storage Battery Company. This injunction becomes effective on Aug. 1, as the railway company was given until that time to remove the infringing batteries. This is one of four or more suits which are the outgrowth of that in which a preliminary injunction was granted against the Hatch Battery Company on May 5 last.

DAMAGES FOR CONTINUED TRESPASS.—The Postal Telegraph-Cable Company, having put up two telegraph poles in front of property owned by Thomas Comisky, the latter brought suit in the New York Supreme Court for an injunction and damages, and on the trial was awarded a verdict of $250. An order granting a new trial, on the ground that the verdict was excessive, has been affirmed by the Second Appellate Division, which held, by Justice Cullen, that the plaintiff had been erroneously allowed to prove, by the opinion of a witness, the depreciation of the value of his property because of the erection and maintenance of these poles. The court held that opinion evidence was incompetent to prove that fact, and the fact itself was incompetent. It was only in equity that a recovery could be had for damages to the fee of the property from a permanent nuisance of continued trespass.

PERSONAL.

MR. JOHN W. HOWELL, of the General Electric Company's lamp works at Harrison, N. J., has had the honorary degree of electrical engineer conferred upon him by the Stevens Institute of Technology, of which he is a graduate.

MR. JOSEPH WETZLER, president of the Electrical Engineer Institute of Correspondence, has had the honorary degree of electrical engineer conferred upon him by the Stevens Institute of Technology, of which he is a graduate.

MR. A. F. NAGLE, of Chicago, has been appointed mechanical engineer in charge of the construction of the new electrical power plant which the Manhattan Elevated Railway of New York City is to put in for the electrical operation of its system.

MR. G. R. BOYCE, formerly assistant city engineer of Indianapolis, has become a member of the firm of S. C. Boyce & Son, Race Street, Cincinnati, who are engaged in the design and construction of electric light and railway plants, and as contractors for all classes of public works.

MR. THOMAS E. ADAMS, of The Adams-Bagnall Electric Company, Cleveland, Ohio, was in New York City for the past month, attending the convention of the National Electric Light Association and the Electrical Exhibition at Madison Square Garden. Mr. Adams now plans an extended trip through the East and South in the interests of his company.

MR. LEWIS BELLOWS, who has been connected with the Deane Steam Pump Company for the past nineteen years, has resigned his position as New York sales manager for the International Pump Company, being unwilling to give up residence at Holyoke, Mass. Under his management the sales of the Deane Company in 1898 were $600,000, and the profits were over $100,000.

Trade and Industrial Notes.

THE MINERS ELECTRIC REFINING COMPANY of New York has been chartered at Dover, Del., with a capital stock of $500,000.

COLUMBIA AUTOMOBILE COMPANY.—All communications for this concern should now be addressed and sent to the Columbia & Electric Vehicle Company, Hartford, Conn.

THE CENTRAL ELECTRIC COMPANY, Chicago, states that the "Electra" carbons continue giving unsurpassed service to its customers. This firm maintains a large stock of standard sizes.

ALL MATTERS OF DIFFERENCE between the Underwriters' Inspection Bureau of New Orleans and Mr. Thomas S. McLoughlin, electrical contractor, of that city, have been satisfactorily adjusted.

DUTCH GUIANA.—The Berlin Iron Bridge Company, of East Berlin, Conn., has received a contract for a warehouse building 40 feet wide, 120 feet long and 20 feet high, to be erected in Dutch Guiana.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has issued a circular giving a classification of its rheostats for continuous duty according to maximum amperes. The various rheostats of this class are illustrated.

MESSRS. P. C. MIDDLETON & CO., Limited, Aberdeen, Scotland, have removed their head office, show rooms, stores and works to more extensive premises. The head office and show rooms are now at 258 and 260 Union Street, and the stores and works in Union Row.

THE WESTERN ELECTRIC COMPANY, Chicago, has on the press a bulletin fully describing hot wire ammeters and voltmeters. These instruments may be used upon either direct or alternating current, and are made either for switchboards or of the portable type.

THE UNION ELECTRIC COMPANY has been incorporated under the Maine laws, with a capital stock of $500,000. The directors are Charles E. Bailey, Linwood F. Jordan and Hattie A. Jordan, all of Portland, and J. Calvin Knapp and J. K. P. Rogers, M. D., of South Portland.

THE AMERICAN INVESTMENT COMPANY of Elizabeth, N. J., has been organized to manufacture electric motors, dynamos, etc. The capital stock is $50,000. The company was incorporated by F. W. Montgomery and M. F. Griggs, of New York, and Frank Bergen, Elizabeth.

THE FISCHER EQUIPMENT COMPANY, Chicago, is reported to have been awarded the contract by Gen. A. W. Greely, Signal Corps, Washington, D. C., for three Woods automobile telegraph and balloon wagons, to cost about $1800 each, with an addition of $1500 for extra batteries.

THE CONSOLIDATED ELECTRIC COMPANY of New York city has been incorporated under the West Virginia laws. It will deal in patented electrical devices. The capital stock is $5,000,000, and the incorporators are C. P. Curtis, A. Stemmler, W. Thorpe, W. Ward and C. R. Campbell, all of New York city.

THE UNITED ELECTRIC HEATING COMPANY, Detroit, Mich., has just issued a new illustrated price sheet of electric heating and cooking devices of its manufacture. The company has added several new appliances to its list of manufactures, and continues to follow its policy of guaranteeing every appliance sent out.

DIAMOND STATE STEEL COMPANY, of Wilmington, Del., is putting up an open hearth steel plant, consisting of acid and basic furnaces, which will have a capacity of 400 tons per day; a blooming mill, and a universal plate mill. It is to have a large electrical equipment. Mr. Robert Aiken, of Pittsburg, is consulting engineer.

THE KNECHT BROTHERS' COMPANY, 2442 Beekman Street, Cincinnati, Ohio, is the sole manufacturer of patented friction sensitive drill, besides being designer and builder of special machinery and tools. An eight-page pamphlet issued by this company tells all about this sensitive drill, with which electrical artisans should be more familiar.

TELEPHONE BRIDGING BELLS.—The Western Telephone Construction Company, learning that suits are proposed under the recent final decision in favor of the Carty bridging bell patent, has issued a special notice suggesting as a precautionary measure of sure defence the use of its Western Express No. 2 bridged type of telephone.

THE INTERNATIONAL ELECTRIC MINING COMPANY has been organized in Portland, Me., with a capital stock of $500,000. The directors are George D. Burton, Samuel Butler and Murray V. Livingston, all of Boston; Osian P. Adams, Cambridgeport; Harry L. Cram, Portland, and George W. Steiner, Samuel W. Low, of Roxbury.

THE SINGLE POLE LIGHTNING ARRESTER recently put on the market by the Harvard Electric Company, 224-226 South Clinton Street, Chicago, is claimed to be selling well. The manufacturer states that this is the only single pole carbon lightning arrester on the market, and that it embodies features which will interest all telephone and telegraph men.

THE YUKON RIVER is already affording an opportunity for American engine and dynamo builders. The river is open to navigation and the transportation company is equipping its steamers with Case engines, built by the New Britain Machine Company, of New Britain, Conn., and dynamos made by the Eddy Electric Manufacturing Company, of Windsor, Conn.

THE C & C ELECTRIC COMPANY, New York, in its Bulletin No. 129, just issued, points out the main features of its bipolar dynamos and motors and ventilating combinations. The straight and curved field-type machines are illustrated, and dimensional diagrams of the same are given. Illustrations of the ventilating combinations, regulators and starting boxes are also shown.

GARTON-DANIELS.—Since Jan. 1, 1899, the Garton-Daniels Electric Company, of Keokuk, Iowa, has sent its arresters into every state in the Union, and has made over fifty shipments abroad. It also states that the sales of these appliances from Jan. 1, 1899, to the present time, are equal to the total sales of any preceding year. This is convincing proof of very high merit in the device.

THE E. L. POWERS COMPANY, 150 Nassau Street, New York City, announces that it has effected an arrangement for the publication of the future issues of the "Electric Railroad List of the World," hitherto published by the Railroad Gazette, and that it will henceforth appear consolidated with the American Street Railway Directory. That publication will not only have the larger circulation, but be improved in every way.

THE E. W. BLISS COMPANY, Borough of Brooklyn, New York City, has issued a small pamphlet, illustrating and pointing out the features of its presses, dies, gears and special machinery for all sheet metal work. The Bliss Company manufactures a complete line of standard machines and tools and makes a specialty of designing and manufacturing machinery for special purposes. It carries a large number of machines in stock.

THE MICHIGAN PIPE COMPANY, Bay City, Mich., immediately after the adjustment of its loss by the recent fire, put a large force of men to work to rebuild its plant. The work is now so far along that the company has resumed the manufacture of water pipe and conduits, and is now serving its customers. Many improvements have been introduced in the new plant which will enable the company to fill orders more promptly than hitherto.

MESSRS. HAVEN & STOUT, bankers and brokers, of 1 Nassau Street, New York City, have issued recently their Red Manual for 1899. It is a most complete statistical work as to railroad and industrial properties, with all the

data presented in compact and handy form. It gives ranges of quotations for securities, etc., and constitutes an accurate and available book of reference for office or library. Its compilers are entitled to great credit.

THE MONTAUK MULTIPHASE CABLE COMPANY, New York, will soon issue a revised price list. This has been made necessary owing to the recent advance in metals. All price lists heretofore issued by this company are subject to this revision. A new book is being made ready for the press, and will soon be issued, giving data for specifications and plans of buildings showing the installation of the cables; also directions for installing. Copies of the same will be forwarded upon application.

EXTRAORDINARY TELEPHONE SHIPMENTS.—A most remarkable shipment of telephones is recorded by the Western Telephone Construction Company, of Chicago, Ill. On Saturday, June 3, this company shipped seven complete telephone exchanges, including switchboards, telephones and appurtenances, each of 100 drops capacity. For one day's business this is the most remarkable in the history of the telephone business. The Western Company reports its May shipments as the largest on record.

THE TURNER ENGINEERING COMPANY, of Bucyrus, Ohio, will erect at once a complete boiler plant for the Marion Steam Shovel Company, including a large self-supporting steel chimney, brick-lined, after special designs. This latter company sends its shovels and dredging machinery to all parts of the world and maintains its plant strictly up to date with the most modern improved money and labor-saving devices. After careful and exhaustive consideration, the management decided to use the Turner boilers.

THE MASON TELEPHONE PAY STATION COMPANY, Ludington, Mich., recently equipped the New Orleans exchange for the Detroit Switchboard & Telephone Construction Company, of Detroit. It has also been equipping for the same company the various exchanges of the Detroit Telephone Company throughout the state of Michigan. The No. 3 desk set pay station has been used exclusively in these installations. The Mason Company reports that its business at the present time is very satisfactory indeed.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburg, has just issued a batch of five catalogues, covering the following named specialties: Transformer fuse blocks; Shallenberger integrating wattmeters; 38-B railway motors; generators and rotary converters for electrolytic work, and belt-driven railway generators. Each of these catalogues is very completely illustrated with half-tone views and diagrams. The catalogues are gotten up in the usual excellent style of the Westinghouse Company.

MECHANICAL DRAFT.—Mr. Walter B. Snow, of the engineering staff of the B. F. Sturtevant Company, Boston, Mass., on Dec. 1, 1898, delivered a lecture before the Engineering Society, Columbia University, New York, entitled "The Influence of Mechanical Draft Upon the Ultimate Efficiency of Steam Boilers." This lecture, which contains much of interest to engineers, has been reprinted from the *Columbia Engineer* in pamphlet form. The subject is exhaustively discussed, and concrete examples are given to show the possibilities of mechanical draft.

THE NATIONAL IRON & STEEL COMPANY of Mingo Junction, Ohio, recently contracted with the Westinghouse Electric & Manufacturing Company for the installation of an electrical equipment in its steel mills. The plant complete will consist of two 150-kw generators, directly connected to two engines of 225-hp each. Current will be supplied at 250 volts to light the mills and offices and operate nine large traveling cranes with capacities ranging from 10 to 30 tons. The chief purpose of the electrical installation is to obtain greater economy in the steel rolling department.

TELEPHONE MATERIAL.—The demand for telephone and line material during the past spring has been so very heavy that it has only been with the greatest difficulty that the large supply houses have been able to keep up with the demand. This has given the Electric Appliance Company of 92 and 94 West Van Buren Street, Chicago, an opportunity to test the facilities of its new building, and it has been able to handle a business in the line of telephone construction material that would have been absolutely impossible if its facilities were not of the very highest order.

THE B. F. STURTEVANT COMPANY, Boston, Mass., early recognized the demand for electrically driven fans, which was sure to follow the general distribution of electricity for power purposes. Its first fan motors were built about ten years ago, since which time designs have been perfected, the number of types greatly increased, and a large electrical department established. Some of the recent products of this company in the way of special electric fans are presented in its Bulletins H and M. The former relates to the enclosed fans, the latter to propeller ventilating wheels.

THE MICA INSULATOR COMPANY of New York, Chicago and London reports a very heavy increase in the volume of business during the last two months. The company's line of insulating materials, viz., "micanite" plates, segments, rings, etc., "Empire" insulating cloths and papers, and M. I. C. compound are being used very extensively by the leading builders of electrical machinery throughout the United States and European countries. Those having had no experience in the use of "micanite" will do well to correspond direct with the company at New York, Chicago or London.

THE COMMERCIAL ELECTRIC COMPANY, Indianapolis, Ind., has just issued a circular (No. 17) of its reciprocating electric pumps, which the company is installing in a number of large mines. Illustrations are shown of the geared electric mine pump, ironclad mine pump, duplex elevator pump, house-service pumps and boiler feed pumps. These have been produced to meet a demand for pumps which can be controlled and operated at a distance, and are furnished in any capacities up to and including 2000 gallons per minute for a maximum pressure of 300 pounds per square inch. All gearing is accurately cut from the solid and the pinions on the motors are of rawhide. All pumps are double action. The installation of these pumps in mines, it is stated, effects high economy.

CEDAR RAPIDS ELECTRIC LIGHT & POWER COMPANY.—The Chicago office of the Westinghouse Electric & Manufacturing Company has received a contract from the Cedar Rapids Electric Light & Power Co., Cedar Rapids, Iowa, for a complete electrical equipment, consisting of one 400-kw, two-phase generator, delivering current at 1100 volts. This generator is an addition to two others previously installed, and doubles the capacity of the power house. The contract also includes a complete switchboard of a new and novel design. This switchboard is equipped with high tension circuit breakers and switches. The Cedar Rapids Electric Light & Power Company has built up a large business in supplying electric current for motors in mills and factories, as well as in supplying incandescent lamps in houses, and arc lamps for street lighting. This is another case in which supplying electricity for light and power purposes has been found so highly remunerative that within a short period the amount of power has been doubled.

THE HARRISON SAFETY BOILER WORKS, Philadelphia, Pa., have made the following recent sales of the Cochrane feed water heaters and purifiers: Alabama Steel & Wire Company, Ensley, Ala., 6000-hp; Ohio Steel Company, Youngstown, Ohio, 10,000-hp; Hoopes & Townsend, Philadelphia, 1000-hp; American Steel Foundry Company, St. Louis, Mo., 850-hp, and Dickson Manufacturing Company, Scranton, Pa., 200-hp, and sales of the Cochrane steam separator to the Franklin Mining Company, Hancock, Mich., 14 and 6-inch; Carnegie Steel Company, Pittsburg, three 16-inch and one 10-inch; Laughlin & Co., Limited, Pittsburg, six 5-inch, five 10-inch, one 7-inch, one 4-inch, two 6-inch and two 12-inch; Cambria Steel Company, Johnstown, Pa., two 13-inch; American Blower Company, London, England, 4-inch; Gisholt Machine Company, Madison, Wis., 14-inch; Monongahela Furnace, McKeesport, Pa., 2 and 2½-inch; Brier Hill (Ohio) Iron & Coal Company, two 12-inch; E. W. Blatchford Company, Chicago, 5-inch; National Tube Works, McKeesport, Pa., 3-inch; Denver Engineering Works Company, Denver, Col., 4½ and 5-inch; Norton Bros., Maywood, Ill., 6-inch.

TEST OF A GAS ENGINE.—Mr. W. Watson, engineer of the Watson Manufacturing Company, Jamestown, N. Y., made a test of a No. 10 Climax gas engine recently installed in that company's plant. In a report from the Watson Company to the manufacturer of the Climax engine, the Erie Gas Engine Company, Erie, Pa., the record of the test shows very satisfactory results. The engine tested is of the four-cycle type, running at 200-r.p.m. The test run was for six hours. Running at 40-bhp the number of explosions per minute was 86. The minimum gas consumption was 10 feet per bhp per hour; maximum gas consumption was 11.6 feet per bhp per hour; average consumption 10.8 feet. The guaranteed power of the engine as per contract was 40-bhp, and the guaranteed gas consumption 13 feet per bhp per hour. The test showed that the surplus power above the guarantee was more than 22 per cent., and the gas consumption more than 15 per cent. less than the guarantee. The Watson Manufacturing Company is highly pleased with the engine and its performance. The Erie Gas Engine Company rates its engines conservatively, and supports its claims by actual tests. The Climax engine is stated to be a machine of great simplicity, durability and ultimate economy.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JUNE 13, 1899.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

626,661. ELECTRIC ARC CARBON; Daniel Bacon, of New York, N. Y. App. filed Jan. 13, 1898. (See Current News and Notes.)

626,667. ELECTRIC SIGN; C. A. Chase, Chicago, Ill. App. filed March 28, 1899. In order to make the letters of the sign interchangeable the conductors from each letter are passed through a slot in the face of the board and are connected at the back of the board with the mains, the connections being of such character that it may be readily severed and established.

626,670. ELECTRICAL BURGLAR ALARM; Clyde Coleman, of Chicago, Ill. App. filed Nov. 10, 1896. (See Current News and Notes.)

626,684.—ELECTRICAL SAFE PROTECTION; Henry F. Freed, of Harrisburg, Pa. App. filed Dec. 13, 1898. (See Current News and Notes.)

626,704. RAILWAY SIGNAL; J. Kasmeier, Florence, Ala. App. filed April 27, 1898. The invention here, which consists of the details of the apparatus, provides for the automatic setting of the signals at the ends of the blocks by the trains.

626,708. ELECTRIC MOTOR; Robert Lundell, of New York, N. Y. App. filed July 16, 1898. Relates to means for detachably securing the commutator brushes in place and connecting the same with the circuit conductors; and means for securing the fan guard to the body of the motor.

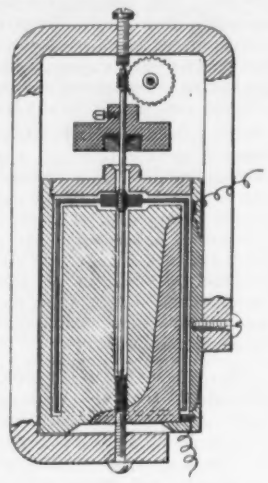
626,713. SELF-REGULATING DYNAMO; M. Moscowitz, Newark, N. J. App. filed Oct. 4, 1898. The object is to maintain the output of a dynamo constant under varying speed conditions. The dynamo has a differential series field coil and a self-excited field coil in circuit with its armature; also a high resistance shunt coil around the field fed from a battery.

626,717. ELECTRIC ARC LAMP; H. R. Ottesen, Hanover, Germany. App. filed Jan. 5, 1899. The carbons are nearly horizontal. At the meeting point a plate of non-conducting material is inserted for maintaining the points at a constant distance apart. The arc travels around the edge of this plate and as both carbons are fed by gravity the arc is maintained at a substantially constant length.

626,787. ELECTRODE; William E. Irish, of Cleveland, O. App. filed Jan. 3, 1898. (See Current News and Notes.)

626,798. ELECTRICAL SWITCH; E. J. Wade, London, England. App. filed Dec. 17, 1898. The object is to provide means whereby the cells of a battery may be altered from one working combination to another without short-circuiting any of them, and yet without breaking the main circuit. For this purpose a number of intermediate combinations are introduced through which the changes are effected. The method used is that of passing from one parallel combination to another by first cutting out one or more of the parallels, then reintroducing in parallel the whole or part of the cells cut out but coupled up in a different series, then cutting out the remainder of the first parallels and finally reintroducing in parallel all the cells out of circuit grouped according to the new series.

,806. SELECTING INSTRUMENT; A. Duppler, Jersey City, N. J. App. filed Aug. 18, 1897. The general features of the improvement consists in part of the use of two magnets having a common current received from a suitable transmitter, one of which responds promptly and turns a contact arm, and the other responds only when the impulses stop for a moment and the current is allowed time to operate it.



626,832.—Electric Meter.

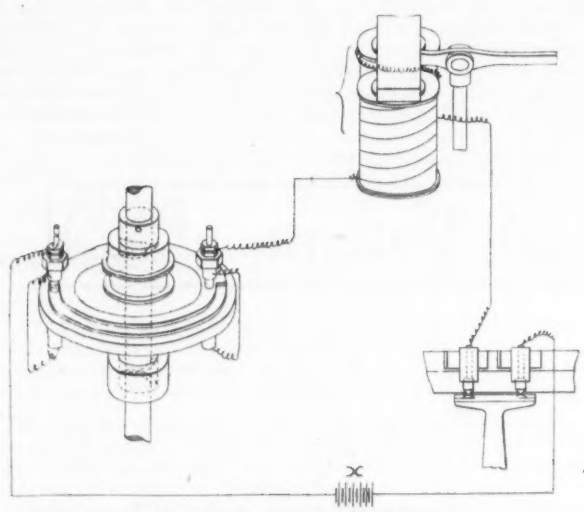
626,826. TELEPHONE CIRCUIT; P. G. Burgess, Mexico, Mexico, and H. W. Wilder, Springfield, Mass. App. filed March 16, 1899. The invention comprehends a compound circuit arrangement wherein three telephones are so placed and connected that while the receiving instrument of one of them which we may call A shall be responsive to the transmission of both of the others, B and C, and shall be able to reproduce the messages transmitted by means of the said others the receiver of B will not respond, receive or reproduce the transmission of C, and the receiver of C will in like manner be neutral or irresponsive to B.

626,832. ELECTRIC METER; C. S. Halsey, Chicago, Ill. App. filed May 23, 1898. The current to be measured traverses a motor having a constant magnetic field in which rotates an armature consisting of a continuous piece of copper carried by a vertical shaft which is geared through a worm to the recording mechanism. But a small part of the armature stands in the magnetic field at one time. The current is led to the armature by two electrodes that dip into the mercury in which the armature is submerged at opposite borders of the field, so that the current will have to travel the whole length of the field.

626,833. SYSTEM OF ELECTRIC METERING; C. S. Halsey, Chicago, Ill. App. filed July 1, 1898. The invention consists of two interchangeable registering mechanisms at the point of consumption, and means for throwing one set off and the other set on from the generating station which in most cases will consist of the neutral wire of the lighting system and a ground return.

626,835. ELECTRIC BLOCK SYSTEM FOR RAILWAYS; G. Knowles, Milwaukee, Wis. App. filed Dec. 26, 1895. This is an automatic signaling system for trolley railways, the invention consisting in the details of construction in the arrangement of the circuits for throwing the signals successively from danger to safety positions.

626,848. ELECTRICAL MEASURING INSTRUMENT; Joseph Wells, of Niagara Falls, N. Y. App. filed Nov. 3, 1898. (See Current News and Notes.)



626,951.—Power Steering Mechanism.

626,918. ELECTRICAL SWITCH; P. Medary, Cynwyd, Pa. App. filed Sept. 2, 1898. A push and pull switch in which a cylindrical plunger having contacts on its surface, moves through a correspondingly shaped passage in a block of insulating material, the walls of the passage having corresponding contacts; the condition of the circuit is determined by the relative position of the plunger in the block of insulating material.

626,919. ELECTRICAL SWITCH; P. Medary, Cynwyd, Pa. App. filed Nov. 30, 1898. A modification of the preceding.

626,922. DUST OR WATERPROOF CASING FOR FIELDS OF ELECTRIC MOTORS; J. H. Wayle, Minneapolis, Minn. App. filed April 6, 1899. The hollow casing open at the ends is divided longitudinally into independent sections, having inwardly projecting flanges at the end and hinged together at their abutting edges to permit the casing to be open from either side.

626,927. INCANDESCENT LAMP SOCKET; E. G. Perkins, Hartford, Conn. App. filed Feb. 13, 1898. The socket is adapted without change for the three standard types of lamp bases, the contacts, connections and casing being so arranged as to receive and connect any of the bases.

626,940. ELECTRIC CABLE; W. S. Smith, London, England. App. filed Nov. 7, 1898. For reducing the inductive capacity of sub-marine cables the cable consists of a solid metallic core having tapes of the same metal wound helically upon it, the diameter of the central conductor being largely in excess of the thickness of the tape.

626,951. POWER STEERING MECHANISM; J. D. Williamson, Jr., Philadelphia, Pa. App. filed Nov. 10, 1898. The object is to provide power steering apparatus with an electromagnetic compensating device whereby any variation between the actual position of the rudder and that indicated by the tell-tale at the steering wheel, will be automatically corrected whenever the rudder is set amid ships.

626,978. ELECTRIC ALARM SIGNAL FOR RAILWAY CROSSINGS; W. H. Donalds and A. E. Flickinger, Berea, Ohio. App. filed Dec. 31, 1897. Details looking to the improvement of the safety feature of electric signals operated automatically at railway crossings.

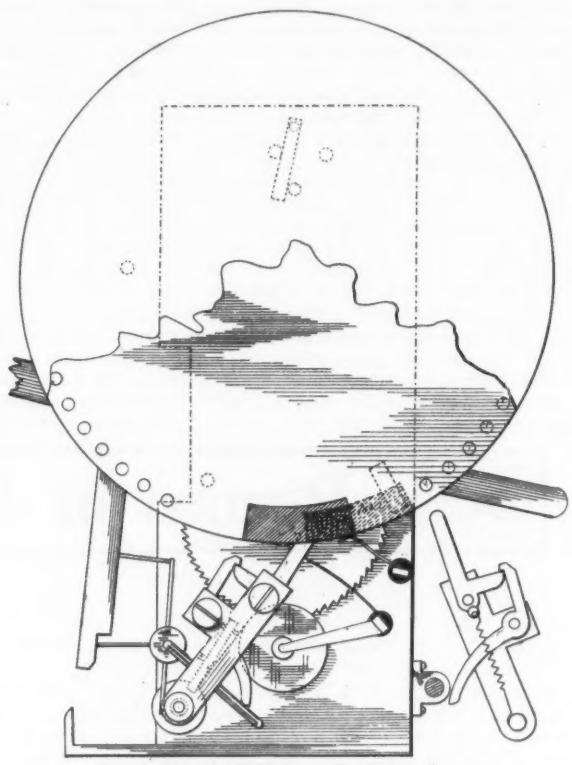
626,979. RAIL BOND FOR ELECTRIC RAILWAYS; J. H. Daniels, Worcester, Mass. App. filed Nov. 25, 1898. This bond is a piece of copper wire rope, the characteristic of the invention being that the strands are loosened and spread at a point between the terminals to increase the flexibility and at the same time permit it to elongate or contract.

626,980. RAIL BOND FOR ELECTRIC RAILWAYS; J. H. Daniels, Worcester, Mass. App. filed April 25, 1899. A modification of the preceding.

626,983. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; W. Decker, Owego, N. Y. App. filed Aug. 6, 1896. At each substation is a motor-driven magneto-electric generator generating currents and controlled by a dial and movable plug for controlling the dial, each of such stations connects with switch operating magnets at the central station by metallic circuits. All batteries for improving the switchboard are done away with.

626,984. COMBINED ALTERNATING CONTINUOUS CURRENT SYSTEM FOR ELECTRIC TRACTION; Max Deri, of Vienna, Austria. App. filed April 27, 1897. (See Current News and Notes.)

627,006. ELECTRICAL BURGLAR ALARM SYSTEM; Henning O. Megaard, of Chicago, Ill. App. filed Nov. 28, 1898. (See Current News and Notes.)



626,983.—Automatic Telephone Exchange System.

627,009. STORAGE BATTERY AND METHOD OF PREPARING ELECTRODES THEREFOR; Leonard Paget, of New York, N. Y. App. filed May 1, 1899. (See Current News and Notes.)

627,054. ELECTRICAL BURGLAR ALARM SYSTEM; Clyde Coleman, of Chicago, Ill. App. filed Oct. 18, 1897. (See Current News and Notes.)

627,066. AUTOMOBILE; J. Schnepf, New York, N. Y. Filed May 6, 1899. A small electric motor is arranged over the rear wheel of a bicycle, a friction pulley on the motor shaft engages with said wheel and thereby aids the rider in the work of propulsion.

1 vol. filed in Gen. Lib. Eng & Soc.

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AND
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NEW YORK, JUNE 24, 1899.

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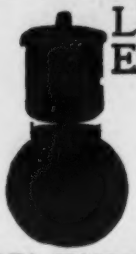

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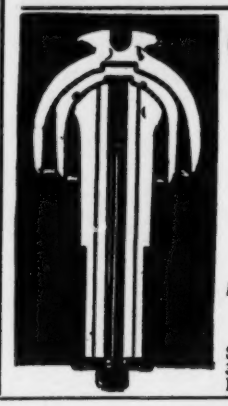

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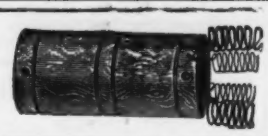

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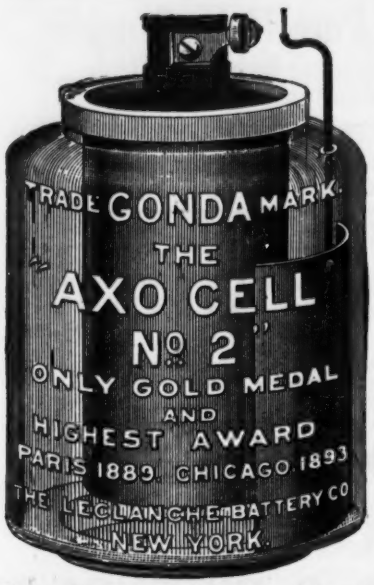

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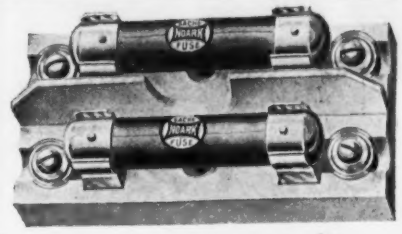

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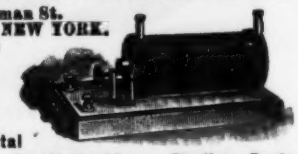

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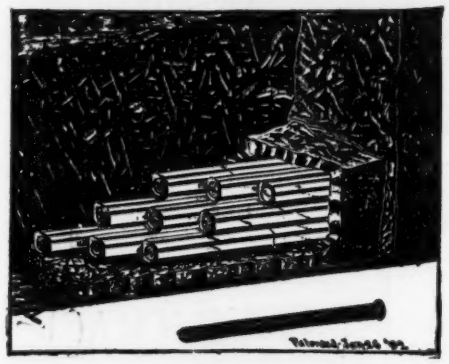

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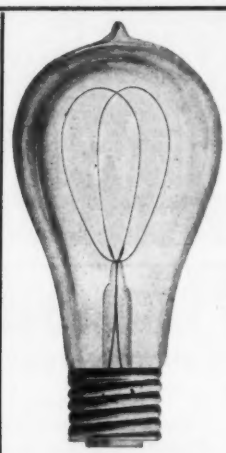

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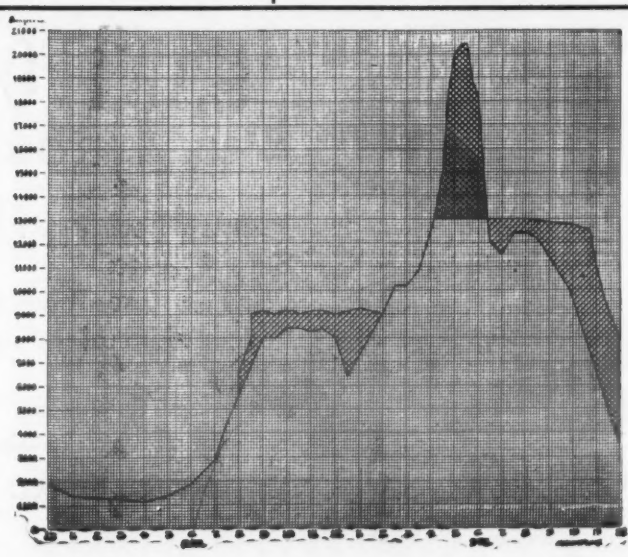

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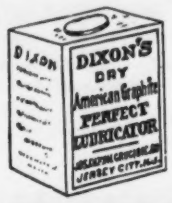

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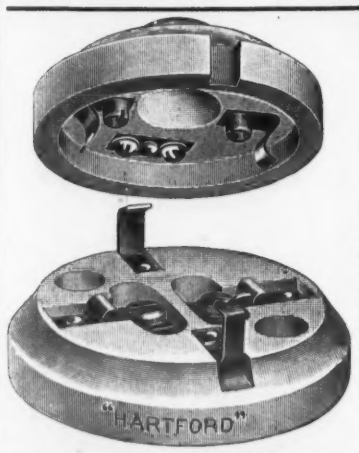

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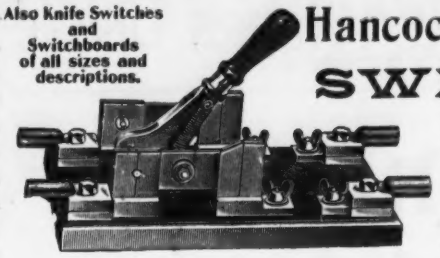

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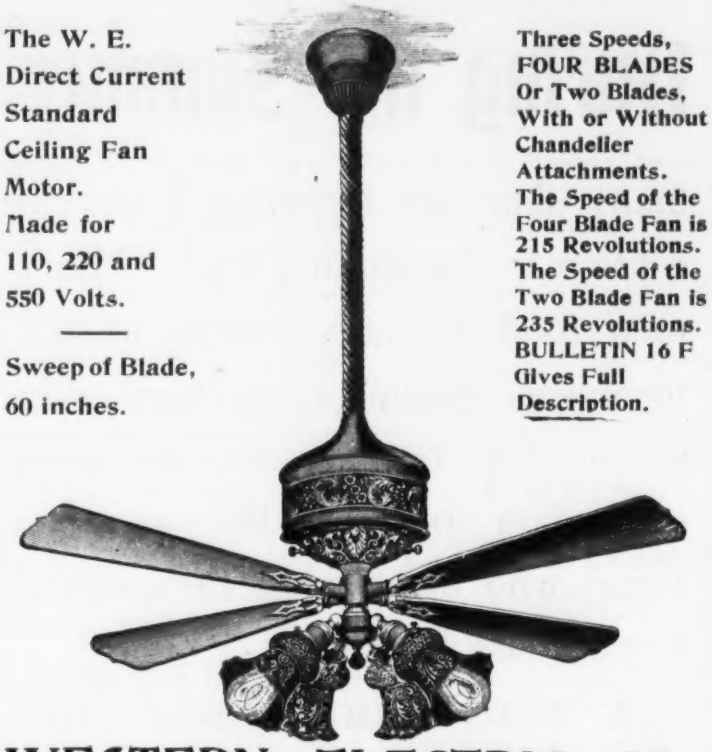

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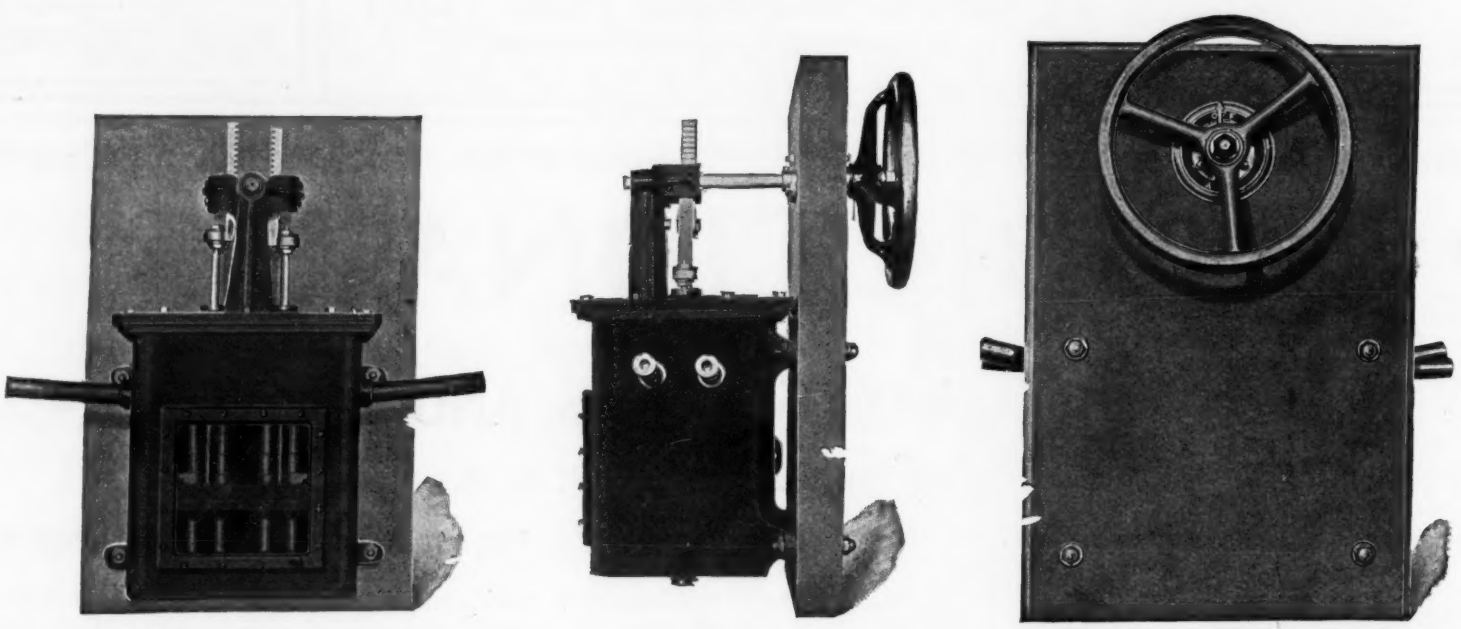

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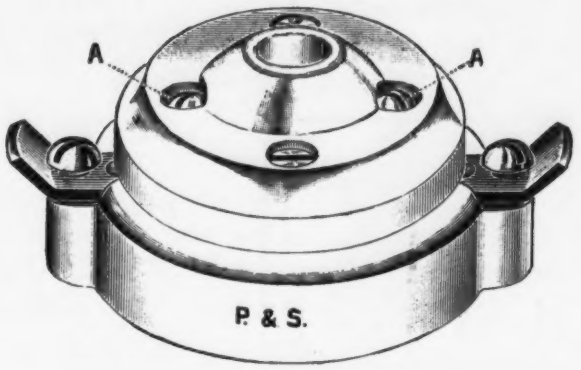

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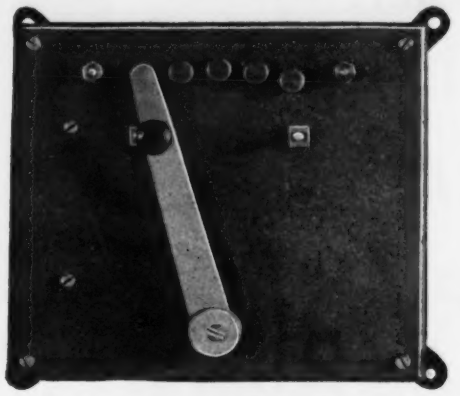

FIG. 150.
"TR" TYPE.

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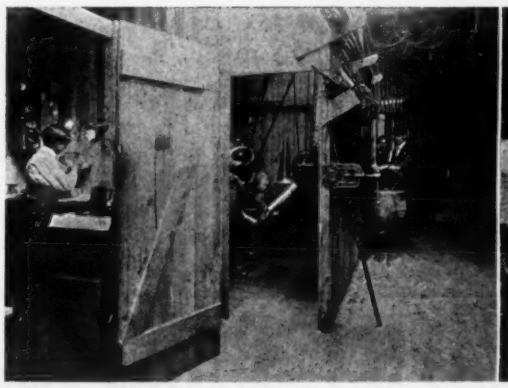

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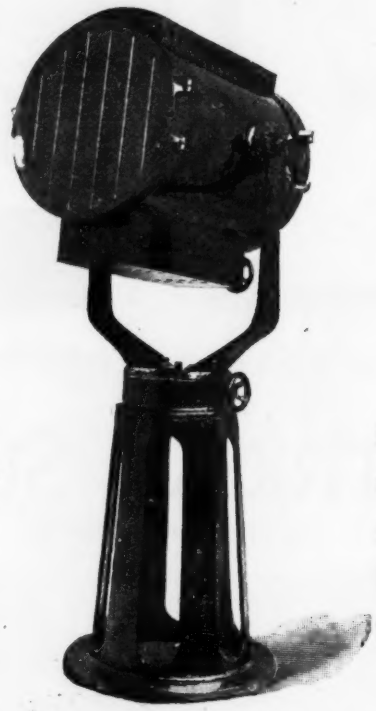

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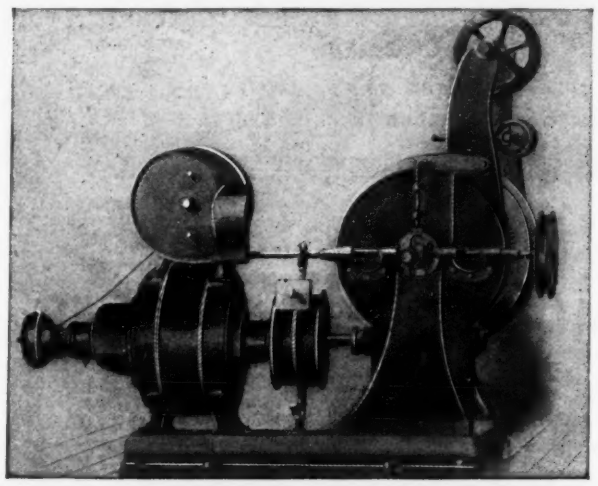

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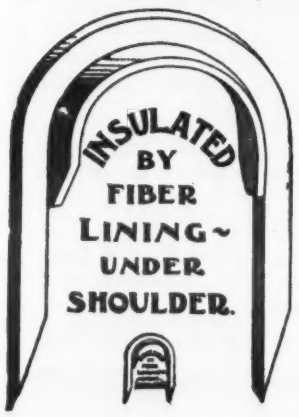

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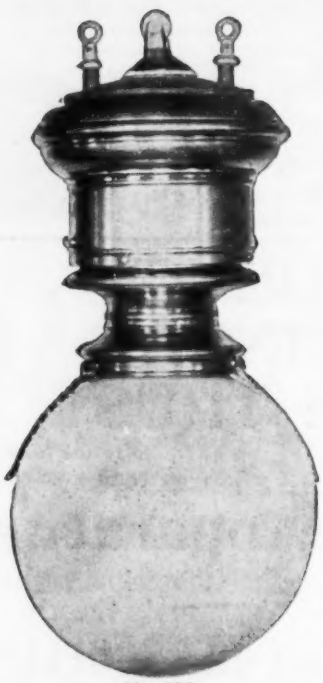

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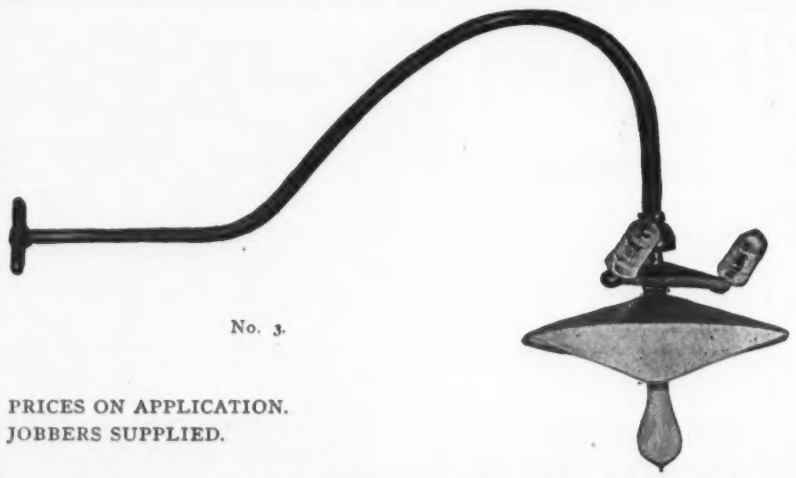

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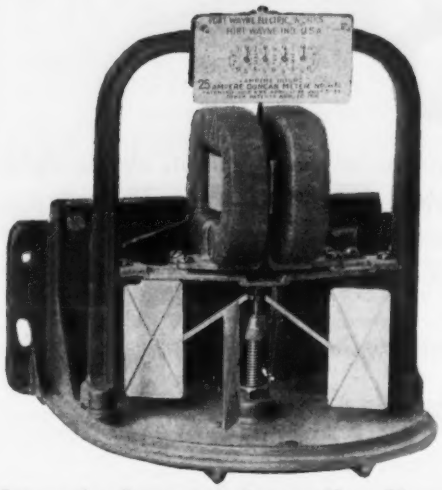

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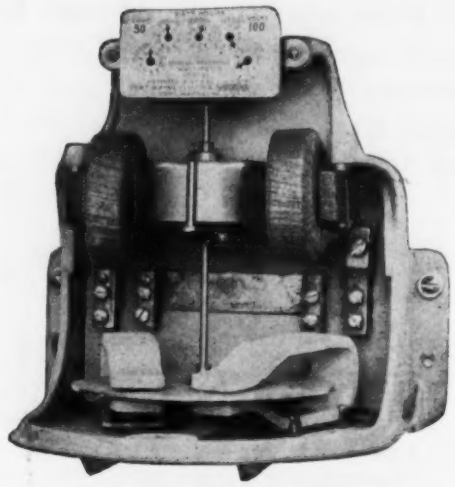

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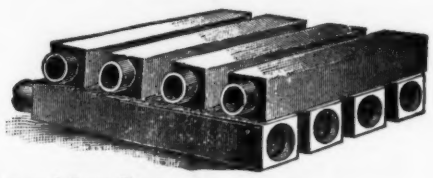

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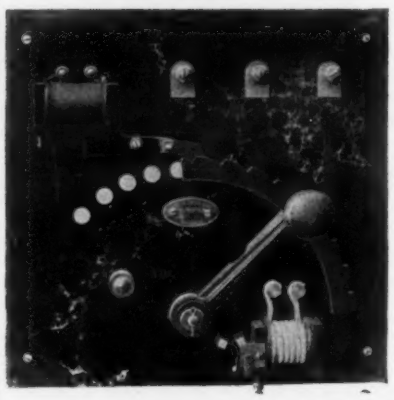

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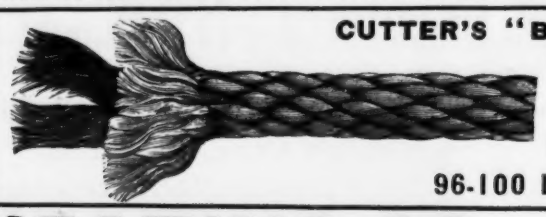

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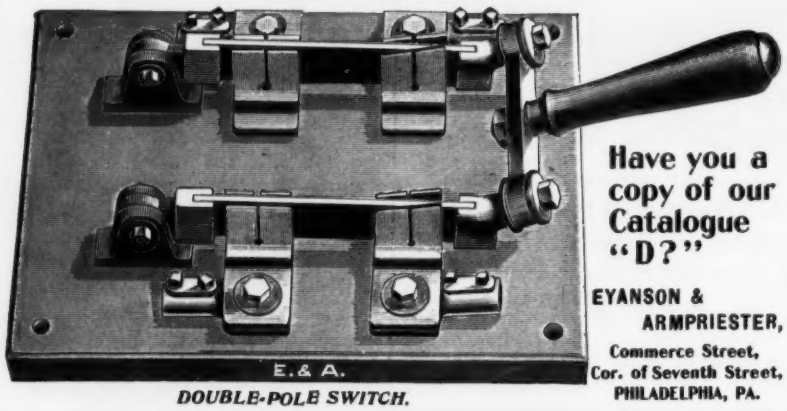

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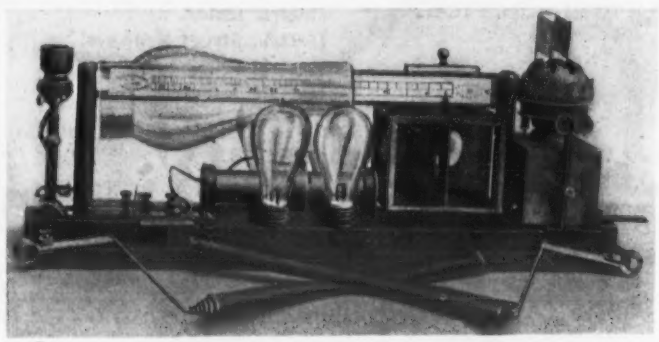

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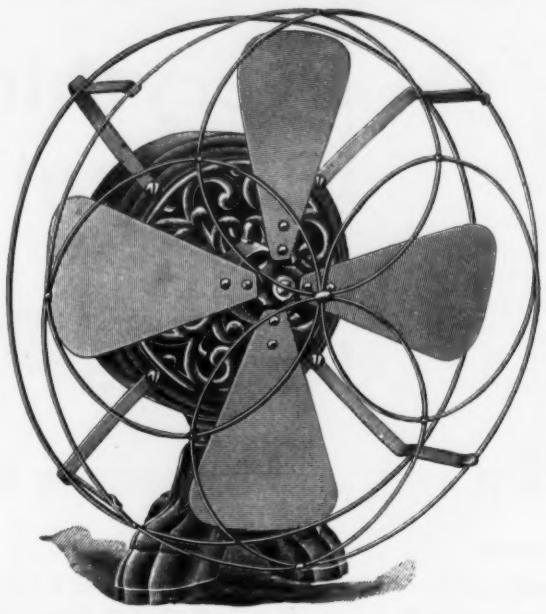

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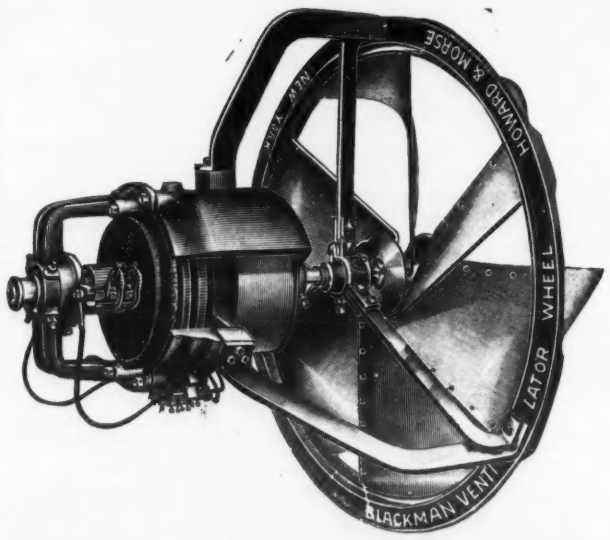

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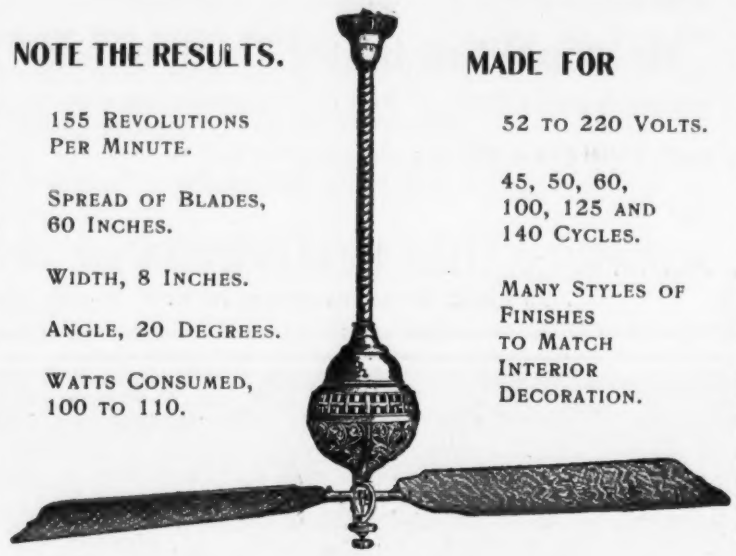

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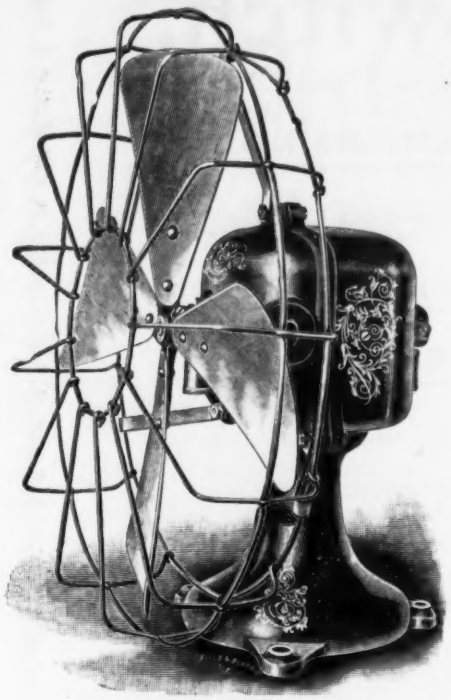

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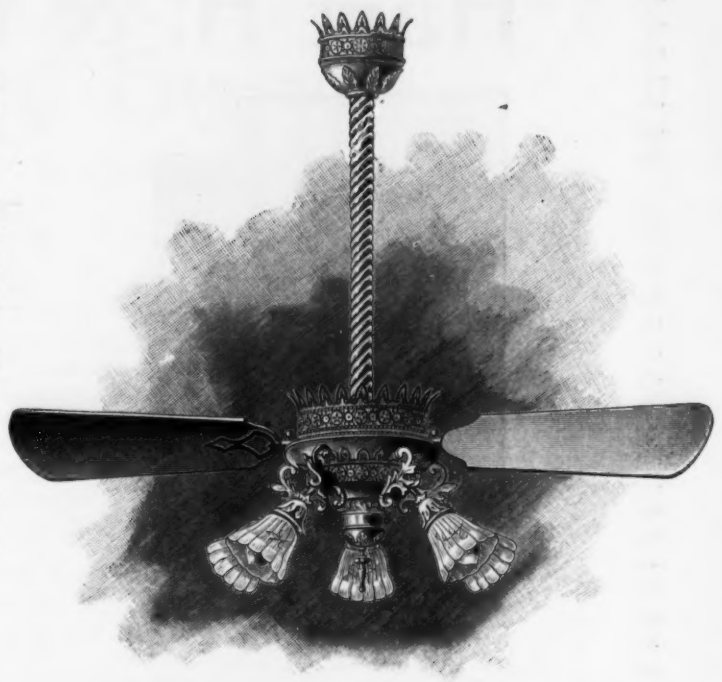

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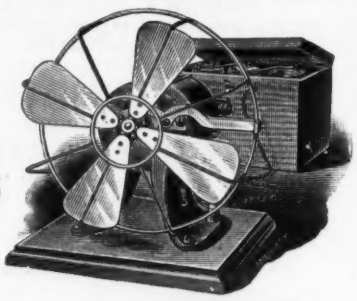

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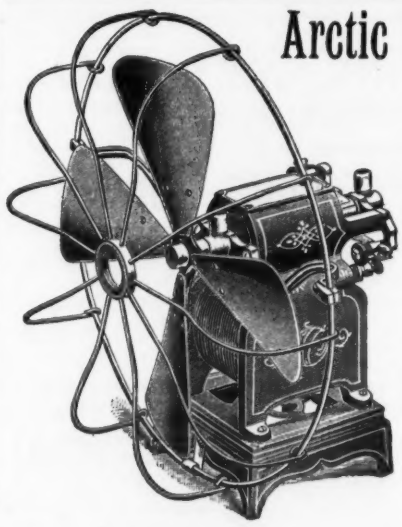

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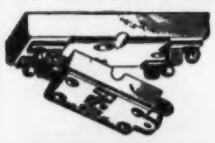

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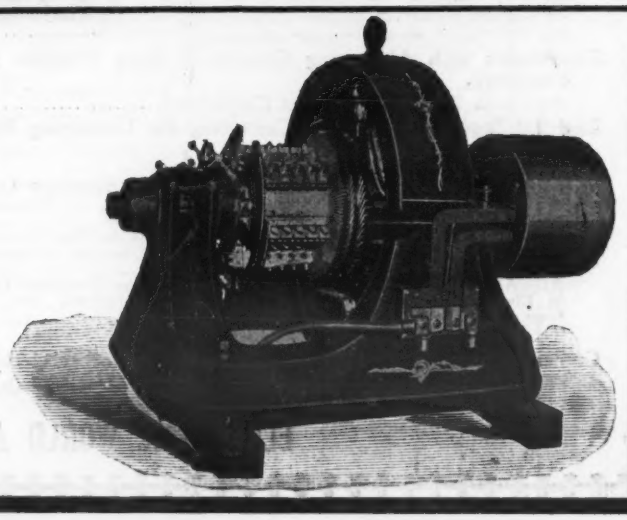

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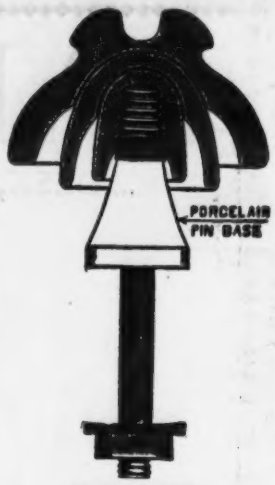

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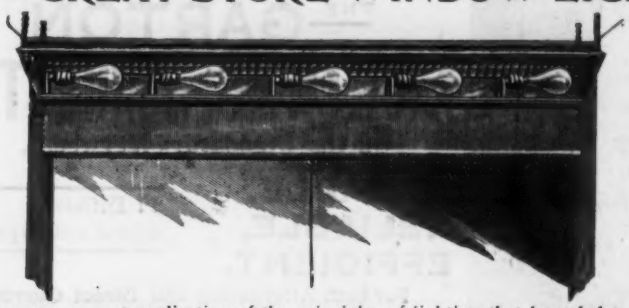

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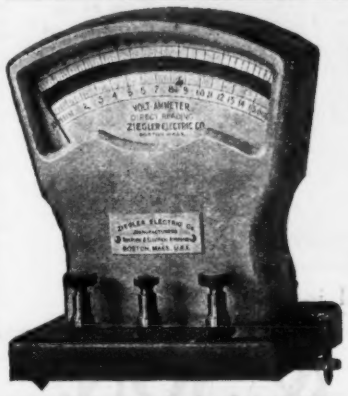

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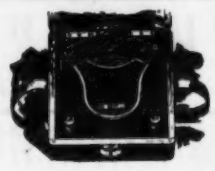

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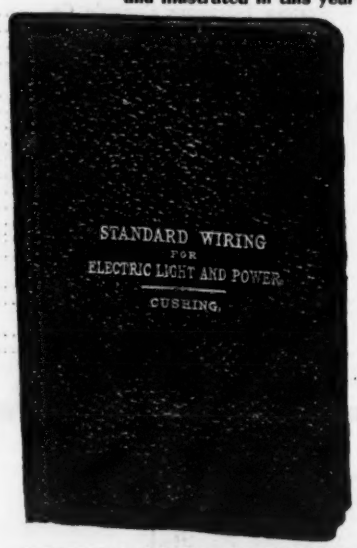

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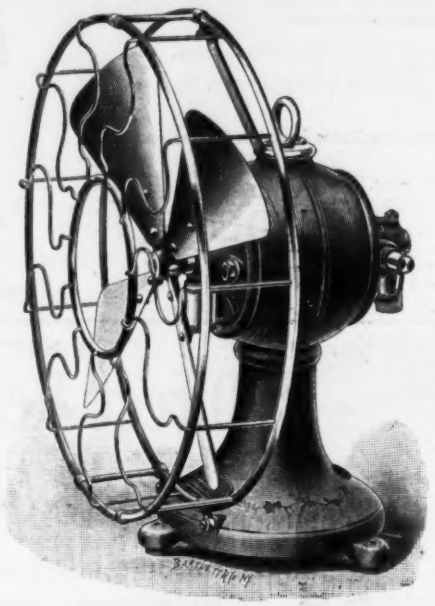

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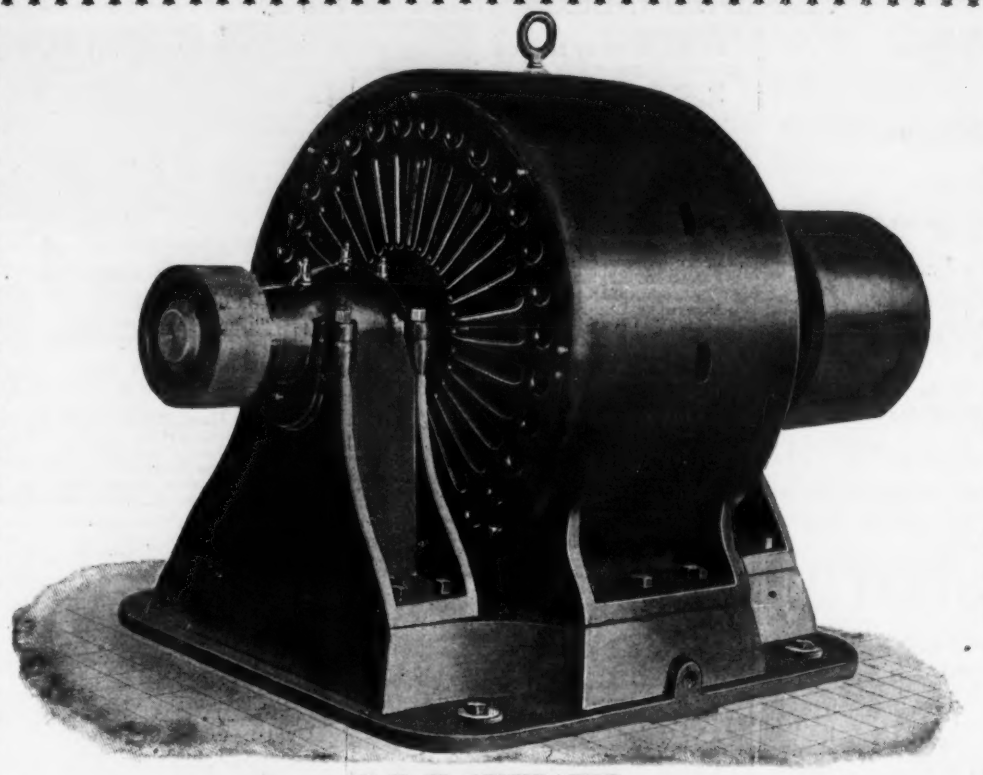

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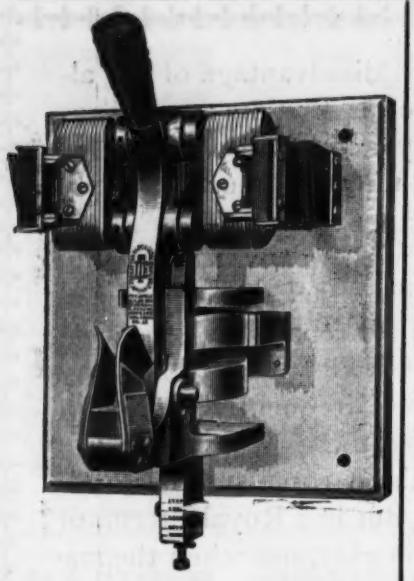

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American Fire Engine Co.
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Fuller Co., The.
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General Electric Co.
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Kammer Co., John.
Lynn Incandescent Lamp Co.
Machado & Roller.
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Sawyer-Man Electric Co.
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Pratt & Whitney Co.
Sebastian Lathe Co.
Watson-Stillman Co.

MAINTENANCE.
Maintenance Co., The.

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Cutter Co., George.

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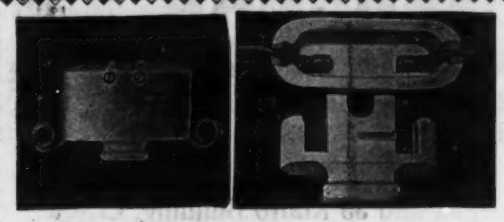

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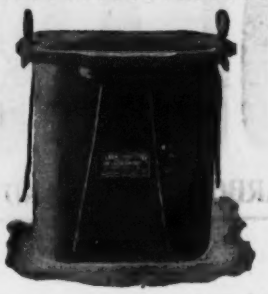

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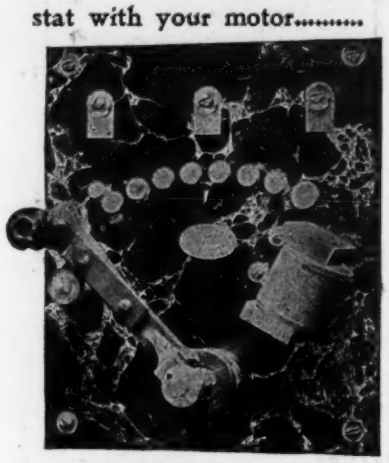

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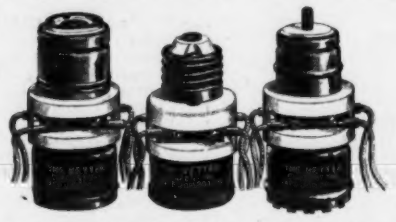

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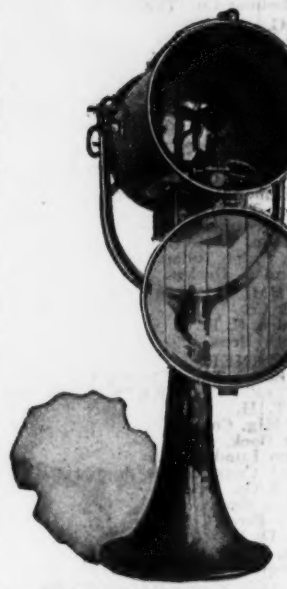

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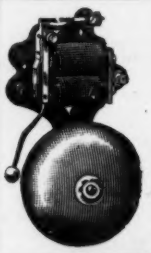

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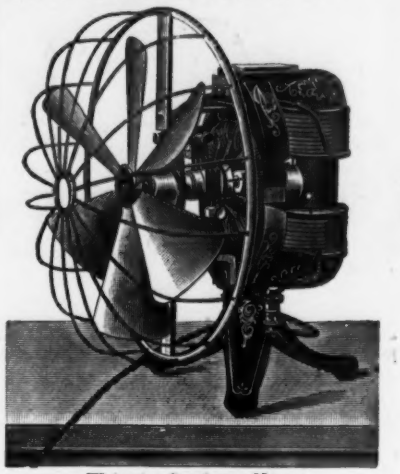

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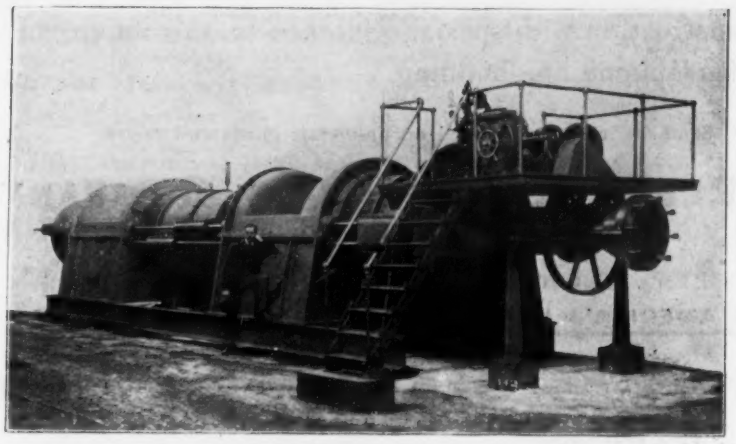

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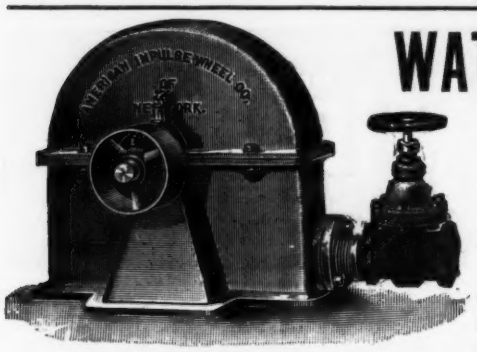

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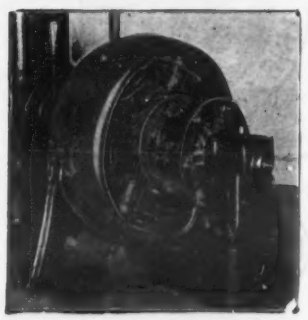

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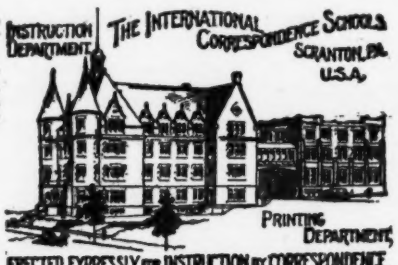

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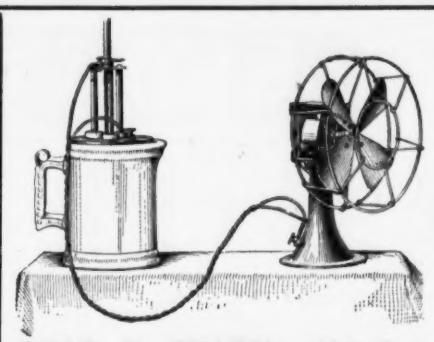

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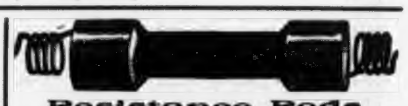

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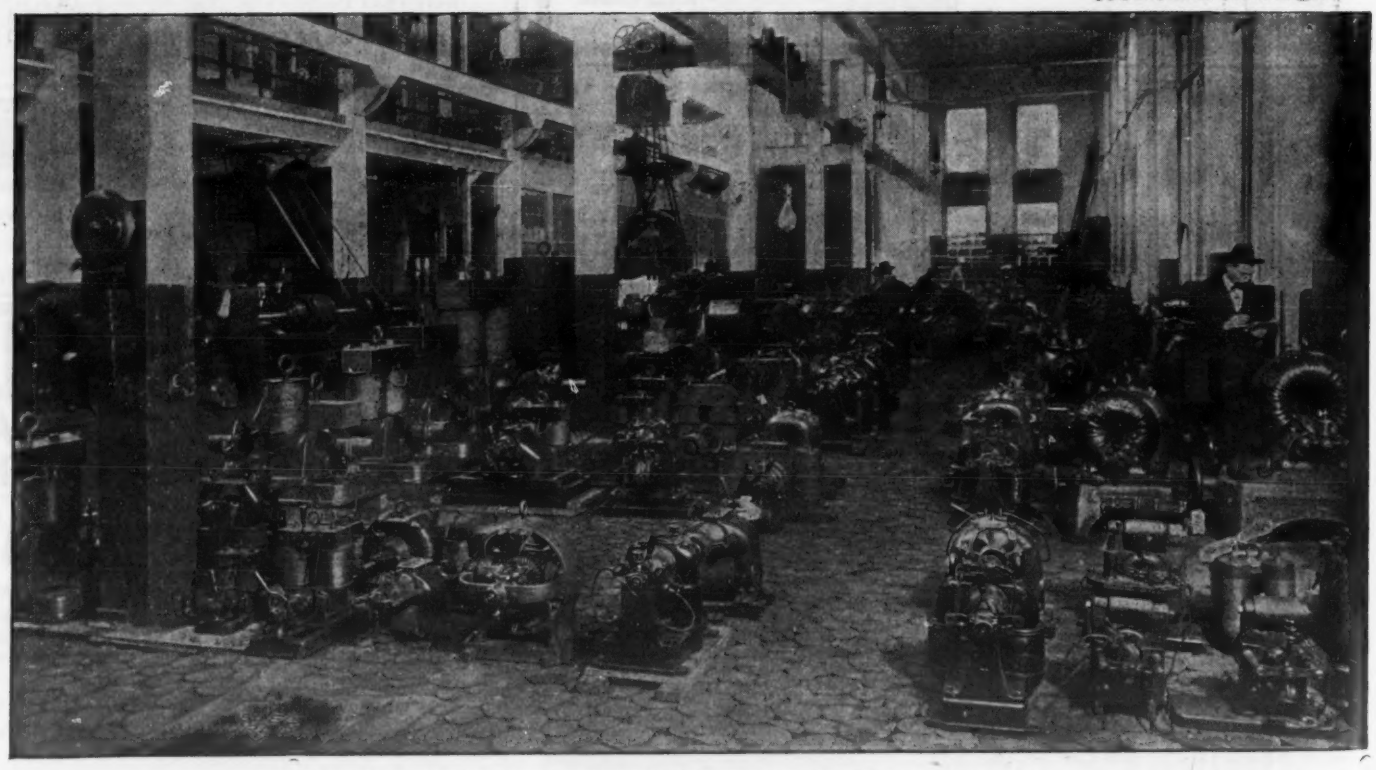

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Extra armatures for all the above.

ALTERNATORS.

2, 60 Kw. Westinghouse, 1000 volts, 16,000 alternations, iron-clad toothed armature.
1, 45 Kw. Westinghouse, 1000 volts, 16,000 alternations, toothed armature.
2, 30 Kw. Westinghouse, 1000 volts, 16,000 alternations, toothed armature, with exciters.
2, A 120 Kw. General Electric, 1000 volts, 16,000 alternations, toothed armature, with exciters and instruments.
1, A 90 General Electric, 1000 volts, with exciter and instruments, practically new; very cheap.
2, A 35 T.H., 1000 volts, 16,000 alternations, with exciters and instruments.
2, 60 Kw. General Electric, 2000 volts, toothed armature, with exciters and instruments.
2, A 18, 300 light T.H., 1000 volts, 16,000 alternations, with exciter.
2, 750 light Westinghouse, 1000 volts, 16,000 alternations, smoothed body armature; very cheap.
2, 180 Kw. Stanley two-phase, 2000 or 1000 volts, latest type, practically new.
2, 150 Kw. Stanley, two-phase, 2000 or 1000 volts, latest type.
2, 300 Kw. Westinghouse, single phase type, ironclad, toothed armature, 1000 volts.
2, 200 Kw., same as above.
2, 240 Kw., same as above.
2, 120 Kw., same as above.
2, 180 Kw. General Electric, single phase, latest type, ironclad, toothed armature, 2000 or 1000 volts, 16,000 alternations.
2, 120 Kw. General Electric, 2000 volts, single phase, ironclad, toothed armature.

DIRECT CURRENT DYNAMOS.

(110 Volts.)

2, 12 Kw. Edison, bi-polar, compound wound.
1, 37 Kw. Westinghouse, compound wound.
2, 100 Kw. Edison bi-polar.
2, 60 Kw. Edison bi-polar.
2, 45 Kw. Edison bi-polar.
2, 30 Kw. Edison bi-polar.
2, 25 Kw. Edison bi-polar.
2, 20 Kw. Edison bi-polar.
2, 15 Kw. Edison bi-polar.
2, 10 Kw. Edison bi-polar.
1, 7½ h.p. Eddy.
1, 300-light horizontal type Westinghouse.
2, M.P., 6-175-150, 125 volts, 175 Kw., General Electric, for direct connection.
2, 75 Kw. Standard, M.P., modern speed, General Electric.
2, 75 Kw. M.P. Westinghouse, modern speed.
2, 30 Kw. T.H., Type H.I.

DIRECT CURRENT MOTOR GENERATORS.

(220 Volts.)

2, 100 h.p. Westinghouse M.P.
2, 80 Kw. Siemens Halske M.P.
1, 25 h.p. C & C.
1, 15 h.p. General Electric M.P.
1, 10 h.p. Westinghouse M.P.
2, 10 h.p. Eddy M.P.
2, 4½ Kw. General Electric M.P.
1, 5 h.p. Eddy.
Besides other machines as small as ½ h.p.

ARC DYNAMOS.

2, 60-light Ft. Wayne, 2000 C.P.
2, 50-light T.H. M.D., 2000 C.P., ring armature.
2, 50-light T.H. L.D., 1200 C.P.
2, 50-light 2000 C.P. Brush, brand new.
2, 45-light 1200 C.P. T.H.
2, 30-light 2000 C.P. T.H.
2, 30-light C.P. Brush.
2, 25-light 2000 C.P. T.H.
2, No. 8 65-light 2000 C.P. Brush.
2, 45-light 1000 C.P. Brush.
2, 30-light 1000 C.P. Brush.
2, 100-light 1000 Excelsior.
2, 75-light 6.8 amp. Westinghouse.
2, 165-light 1200 C.P. Brush, latest type.
2, 120-light 2,000 C.P. Brush, latest type.
2, 125-light 1200 C.P. Brush, latest type.
1, 75-light 1200 C.P., T.H. type M.D., ring armature.

DIRECT CURRENT MOTORS.

(500 Volts.)

1, 50 h.p. Thomson-Houston, D-50.
1, 50 Kw. Western Electric, multipolar.
1, 45 Kw. Edison.
1, 40 h.p. Westinghouse multipolar, 950 r.p.m.
1, 40 h.p. Crocker Wheeler.
1, 40 Kw. Eddy.
2, 40 h.p. Máther, 900 r.p.m.
1, 30 h.p. Westinghouse, multipolar, moderate speed.
1, 30 Kw. Belknap.
1, 25 h.p. Crocker Wheeler multipolar.
2, 15 h.p. Card, 1350 r.p.m.
1, 15 h.p. Keystone, slow speed, 600 r.p.m.
1, 15 h.p. General Electric multipolar, moderate speed.
1, 12 Kw. Edison.
2, 10 h.p. General Electric multipolar, moderate speed.

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26 in. x 48 in. Wright.
13 in. x 13 in. A. & S.
13 in. x 12 in. A. & S.
14 in. x 16 in. N. Y. Safety.
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1 16-light Lundell.
1 35 " Wilson.
1 35 " E & C Multipolar.
1 35 " Card.
1 50 " E & C Multipolar.
1 55 " Edison.
2 65 " Kester M. P.
2 70 " Jenney.
1 75 " Kester.
1 75 " E & C M. P.
1 80 " Roth.
1 80 " Thomson-Houston.
1 100 " Cutten.
1 100 " C & C.
1 150 " Eddy.
1 150 " Mather.
2 150 " Edison 9 K. W.
1 160 " Jenney.
2 180 " Westinghouse.
1 270 " Triumph M. P.
1 270 " Westinghouse M. P.
1 350 " Jenney.
1 350 " National.
2 350 " Edison 20 K. W.
2 480 " Brush.
1 540 " National.
1 800 " Rockford.
1 800 " Mather M. P.
1 800 " Edison 45 K. W.
1 820 " National.
1 1000 " Jenney.
1 1000 " National.

220-VOLT GENERATORS.

1 6 K. W. Fort Wayne.
1 7 " E & C M. P.
1 8½ " Fisher M. P.
2 12 " Edison.
1 15 " T.-H.
1 15 " Edison.
1 20 " T.-H.
2 20 " Edison.
2 25 " Edison.
1 100 " Edison.

500-VOLT GENERATORS.

1 15 K. W. Edison.
1 18 " E & C Multipolar.
1 25 " Edison.
1 25 " Rockford.
1 25 " G. E. direct connected.
1 30 " Jenney.
1 37½ " Westinghouse M. P.
1 40 " C & C.
1 45 " Edison.
1 60 K. W. Edison.
1 100 " Edison.

ALTERNATORS.

1 400-light T.-H. toothed armature.
1 500 " Bain.
1 500 " Westinghouse.
1 600 " General Electric toothed armature, latest type A-30.
1 650 " Standard inductor type.
1 650 " T.-H. A-35.
1 700 " National toothed armature.
6 750 " Westinghouse No. 1.
1 1000 " National.
1 1000 " Westinghouse 2-phased.
1 1200 " Westinghouse 60 K. W. toothed armature.
2 1300 " Slattery.
2 1500 " Westinghouse.
1 2000 " G. E. A-120 toothed armature.
1 4000 " Ft. Wayne 200 K. W. toothed armature.

ARC DYNAMOS.

1 12-light 2000-C. P. T.-H.
1 20 " 1200 " Excelsior.
1 20 " 2000 " Western Electric.
1 20 " 2000 " Brush.
1 25 " 1200 " Wood.
2 25 " 2000 " T.-H.
1 30 " 1200 " T.-H.
2 30 " 2000 " Brush.
1 30 " 2000 " T.-H.
3 35 " 2000 " T.-H.
1 40 " 2000 " Western Electric.
2 45 " 1200 " T.-H.
4 45 " 1200 " Brush.
1 50 " 1200 " Standard.
1 50 " 2000 " Standard.
3 50 " 1200 " T.-H.
1 50 " 2000 " Excelsior.
3 50 " 2000 " T.-H.
4 65 " 2000 " Brush.
3 75 " 1200 " Wood.
1 80 " 2000 " Standard.
1 100 " 2000 " Western Electric.
5 125 " 1200 " Excelsior.

110-VOLT MOTORS.

1 ¼-H. P. Sprague.
1 ¼ " Lundell.
1 1 " Jenney.
1 1 H. P. Lundell.
1 1 " Eddy.
1 2 " Jenney.
1 2 " Wilson.
1 2 " Card.
2 3 " E & C Multipolar.
1 3 " Jenney.
2 4 " E & C Multipolar.
2 4 " Kester M. P.
1 4 " Edison.
1 5 " Kester.
2 5 " Jenney.
1 5 " Roth.
1 5 " E & C Multipolar.
1 6 " T.-H.
1 7½ " C & C.
1 7½ " Cutten.
1 10 " Mather.
1 10 " Eddy.
2 10 " Edison.
1 10 " Jenney.
2 15 " Westinghouse.
2 15 " Edison.
1 18 " T.-H.
1 18 " Triumph M. P.
1 20 " Westinghouse M. P.
1 25 " Jenney.
1 35 " National.
1 50 " Mather M. P.
1 60 " Rockford.
1 60 " National.
1 60 " Edison 45 K. W.
1 75 " Jenney.
1 75 " National.

220-VOLT MOTORS.

1 ¼-H. P. Diehl.
1 ¼ " Lundell.
1 ¼ " Holtzer-Cabot.
2 1 " Eddy.
1 1 " Ahlm-Edwards M. P.
1 1½ " C & C.
1 2 " E & C M. P.
2 3 " Card.
1 3 " E & C M. P.
1 5 " Card.
1 5 " Akron.
1 5 " E & C M. P.
1 7½ " Jenney.
1 7½ " Eddy.
1 7½ " Edison.
1 7½ " E & C M. P.
1 10 " Eddy.
1 10 " Sprague.
1 10 " Fisher M. P.
2 15 H. P. Eddy.
2 15 " Edison.
1 18 " T.-H.
1 18 " Edison.
1 25 " T.-H.
2 25 " Edison.
1 30 " Rockford.
2 30 " Edison.

500-VOLT MOTORS.

1 ¼ H. P. Lundell.
1 2 " E & C Multipolar.
1 3 " Sprague.
1 3 " Toledo.
1 3 " Jenney.
1 3 " G. E. type 1-B.
1 3 " E & C M. P.
1 5 " Detroit.
1 5 " Wood.
1 5 " E & C M. P.
1 7½ " Commercial.
2 7½ " E & C M. P.
1 10 " Detroit.
1 10 " Card.
1 10 " Edison.
2 12 " T.-H.
1 15 " Mather.
1 18 " Edison.
1 22 " E & C M. P.
1 30 " Rockford.
1 30 " Edison.
1 35 " Jenney.
1 50 " C & C.
1 50 " Westinghouse M. P.

ARC MOTORS.

1 ½ H. P. Crocker-Wheeler.
1 1 " Crocker-Wheeler.
1 1 " Excelsior.
1 3 " Brush.

ALTERNATING MOTORS.

1 1 H. P. Fort Wayne.
2 5 " Fort Wayne.
1 2 " General Electric.
4 3 " Westinghouse.
1 20 " General Electric.
1 30 " General Electric.
1 50 " General Electric.

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2 18x30x16 Comp. Westinghouse.
2 13x12 Automatic Armington & Sims.
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6	Dayton 4-Blade Ceiling Fans, 110 volts, D. C.	11.00 "
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15	H. C. Alt. Fan Motors, 16,000 Alt., 104 volts	7.50 "

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MOTORS—110-volt—¼ H. P.; 3 H. P.; 4 20 H. P.; 220 volts—1 H. P.; 3 H. P.; 5 H. P.; 10 H. P.; 15 H. P.; 2 20 H. P.; 500 volts—1 H. P.; 2 H. P.; 10 H. P.; 30 H. P.; also 1 20 H. P., 2-phase, 60 cycles, 220 volts.
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The above buildings produce a total floor space of 72,475 square feet (nearly two acres of floor space). The rooms are high studded, well lighted and provided with best of sanitary arrangements. No. 6 building contains the power plant and is located in the centre of a hollow square formed by the three buildings and is a substantial brick building 31x36 feet. The engine is a 100-H. P. Harris-Corliss, in good condition, and the steam plant consists of a 150-H. P. Babcock & Wilcox boiler. In connection with the steam plant will be found every improved device for the economical production of steam, and there are but few plants that can produce horse power at as low a cost.

Each building is well supplied with means of exit and freight elevators are so arranged as to accommodate every room.

The buildings are favorably located for rental to responsible tenants and are now yielding an annual rental of $13,000, which will give a net income of nearly $7000 after paying taxes, insurance, repairs, cost of power, etc.

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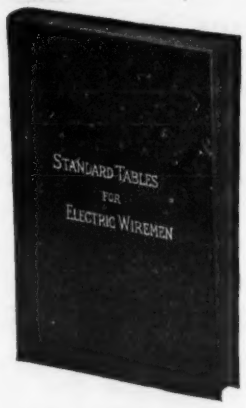

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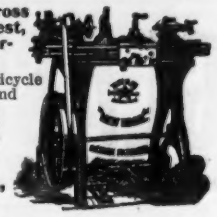

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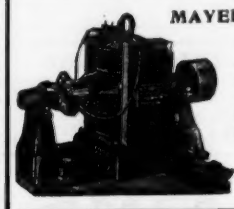

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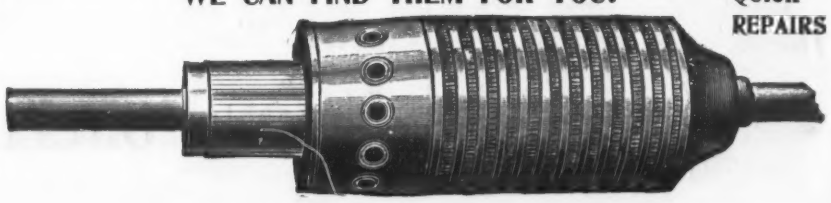

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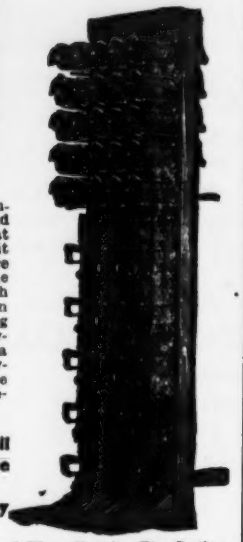

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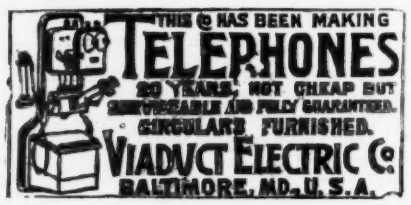

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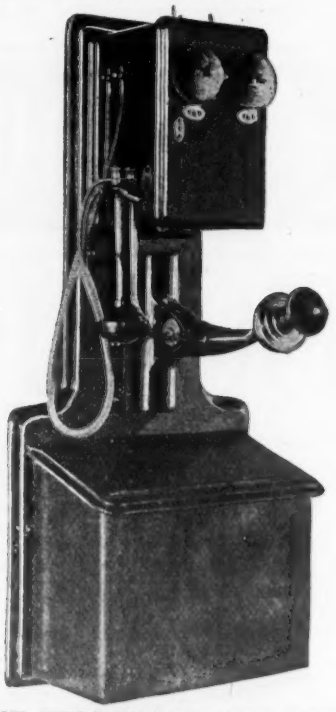

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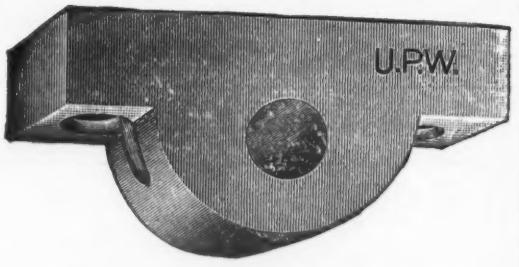

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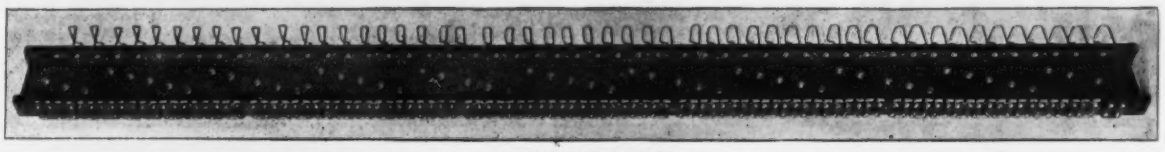

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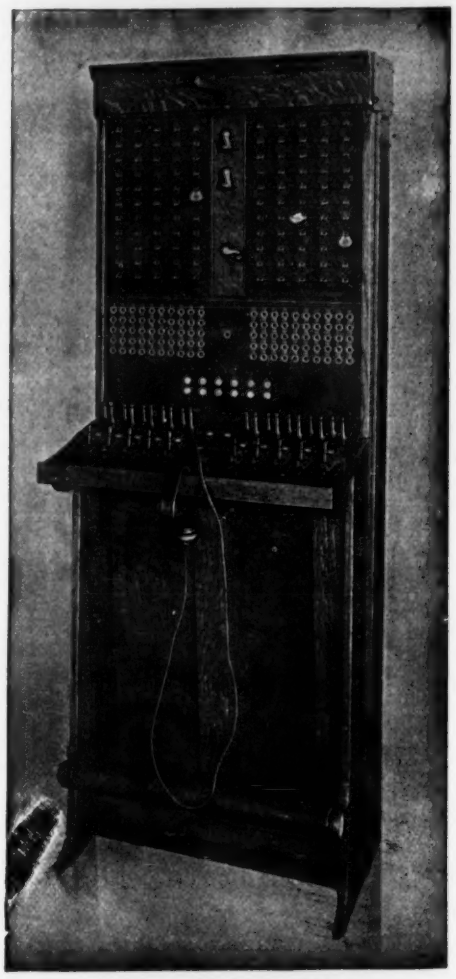

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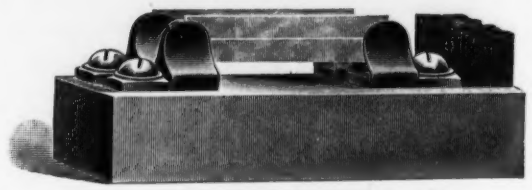

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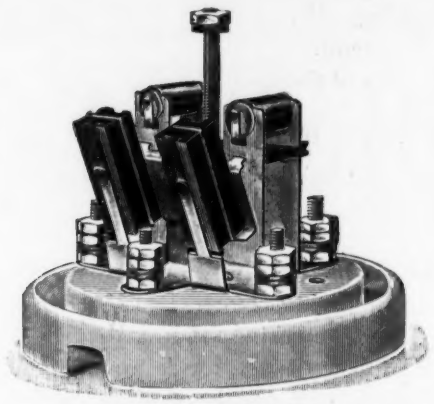

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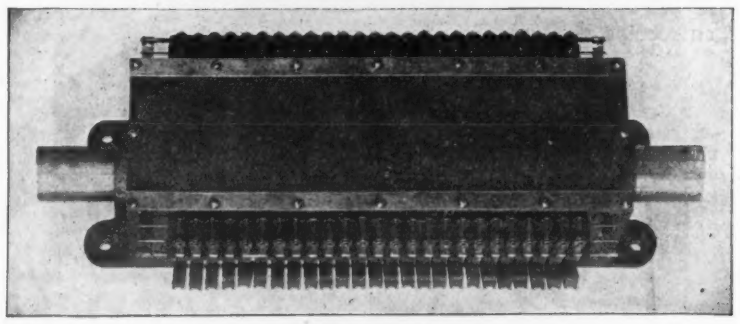

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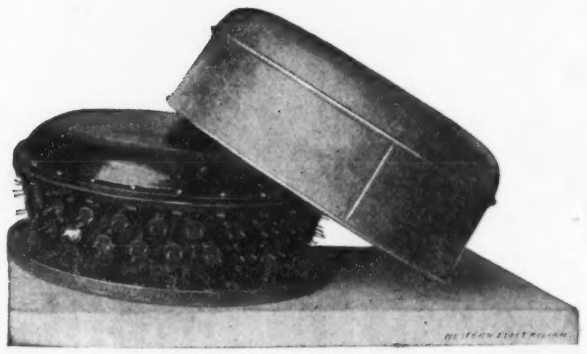

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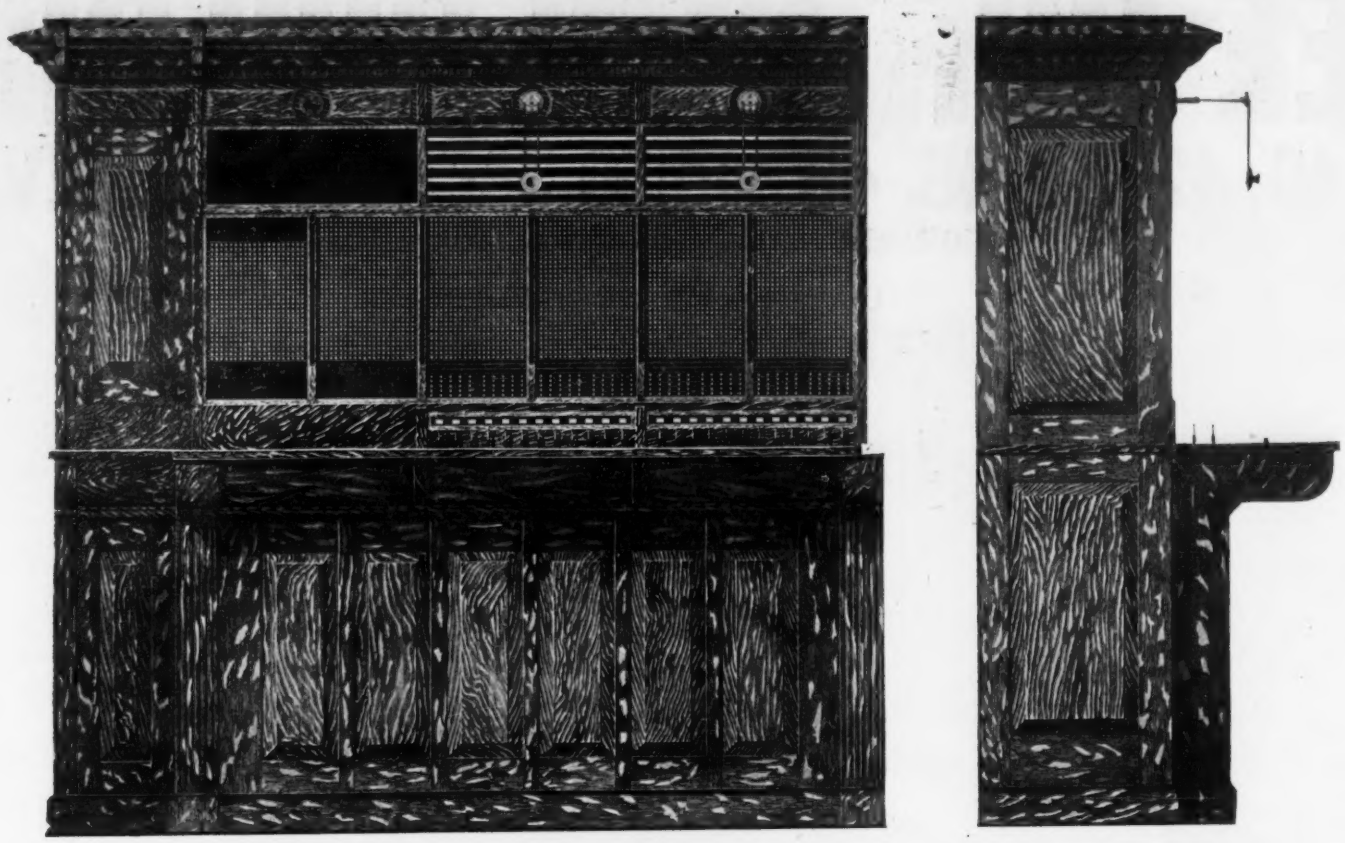

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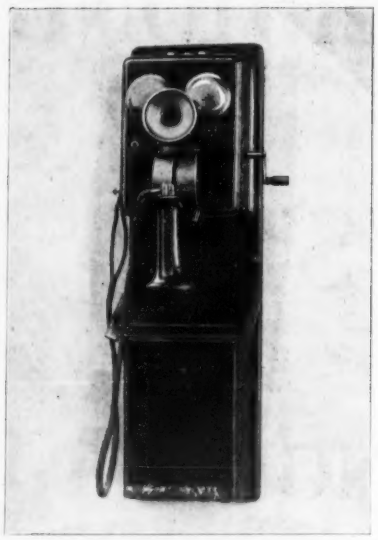

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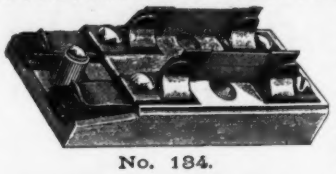

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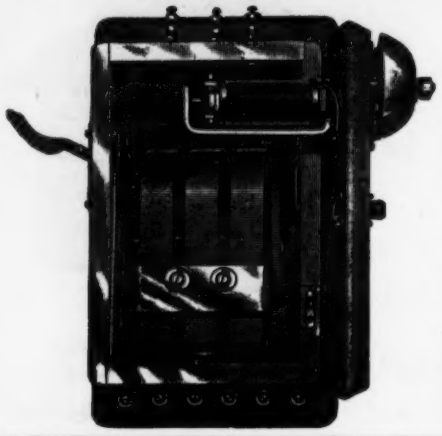

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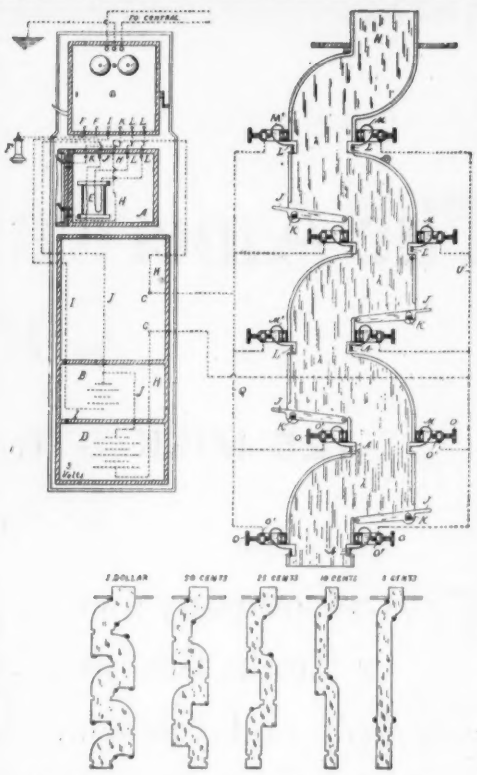

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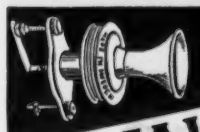

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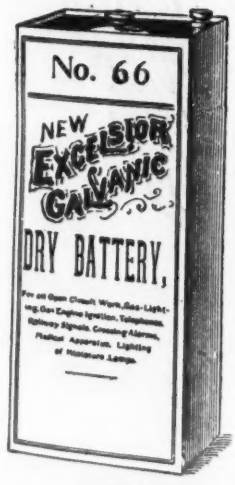

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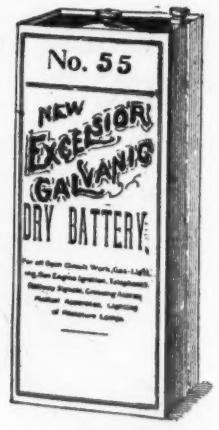

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Amperes.....10 to 12
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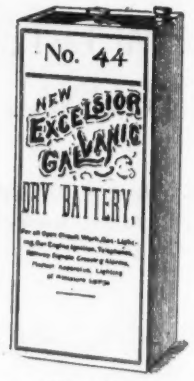

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Volts.....1.6
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List Price.....65c.

4¾ x 1⅛ x 2
Volts.....1.5
Amperes.....7 to 8
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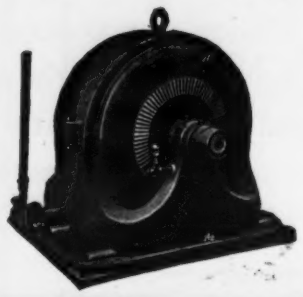

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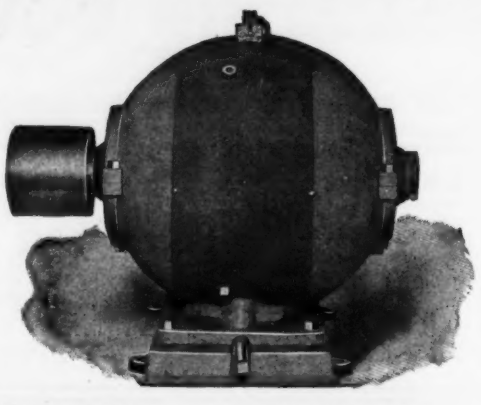

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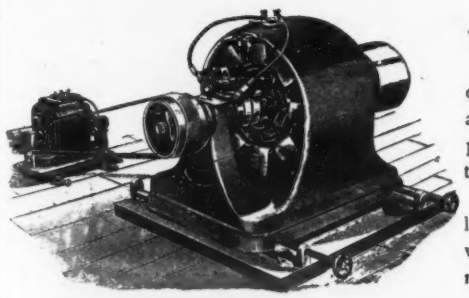

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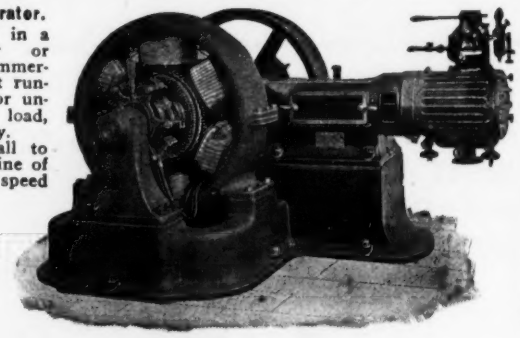

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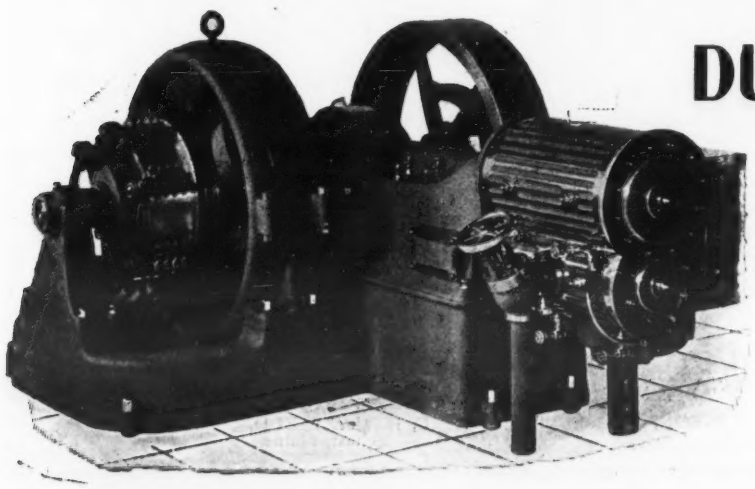

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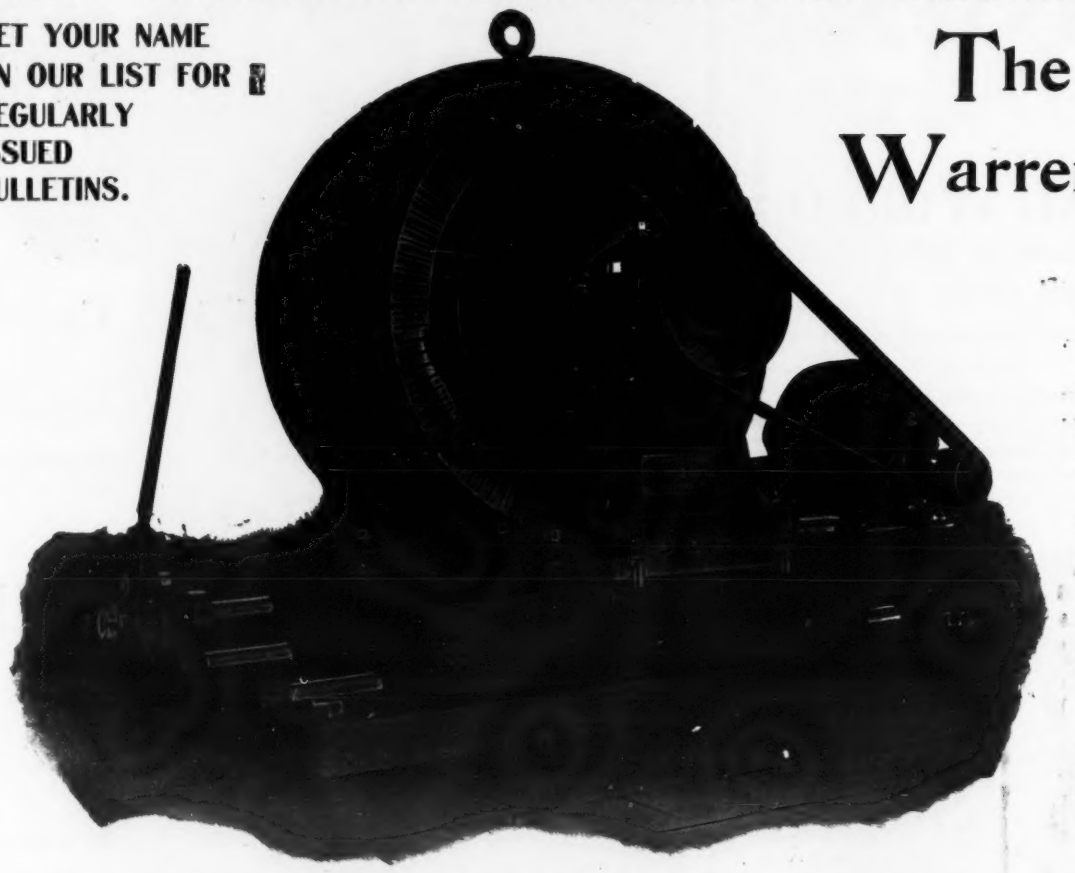

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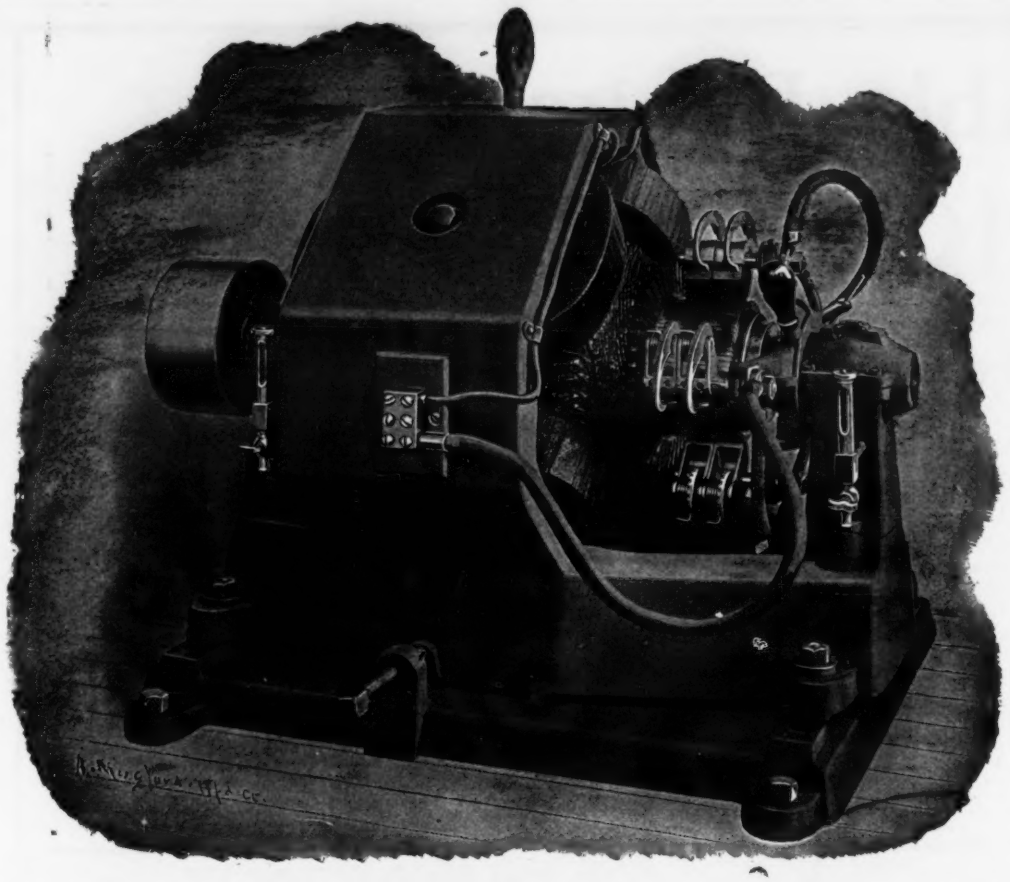

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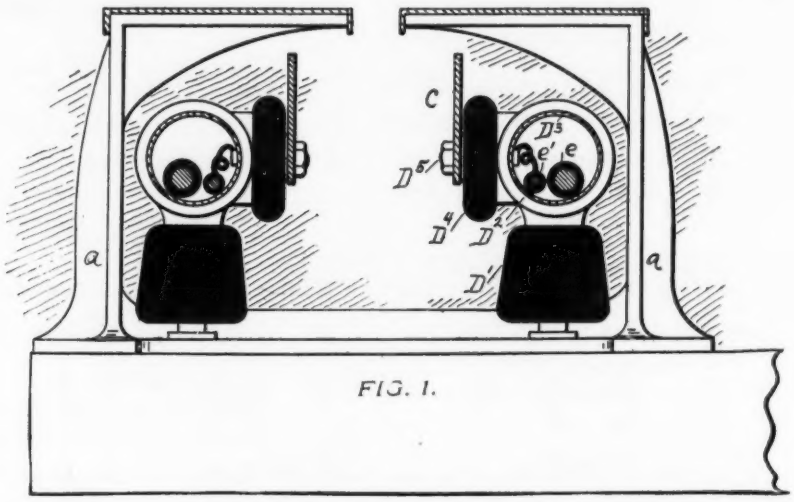

FIG. 1.

Fig. 1 shows a cross-section of the conduit, composed principally of steel casings, with substantial cast iron yokes or frames, about six feet apart, the yokes forming the supports for the pipes and lids also shown. A A is the supporting yoke, D^3 ordinary gas pipe 1½ to 3 inches diameter, supported by insulators D^1.

In this gas pipe is placed the feeders E, which extend the entire length of the track, and connected to these at suitable distances of 500 to 700 feet, by means of switches, and fuses enclosed in water-tight boxes, are auxiliary feeders E^1, each of sufficient size to carry the current and for feeding independent sections of the rails C of the same length, or the distance between the switch boxes.

This admits the cutting out of any section of rails C, either automatically for cause or when necessary for inspection, without interfering with the operation of the line.

Contact between supplementary feeders E^1 and rails C is made every twenty-four feet by the bolts D^2.

The insulators for supporting the pipes and the rails on the pipe are large and especially designed for this purpose.

The contact rail C is of steel, presenting a wide surface for contact with the trolley shoe.

It will be seen that for any of the current to escape it must pass through a quadruple insulation; i. e., the insulation enclosing the feeders, and the insulators supporting the gas pipe, which enclose the feeders on the positive side, also through a like insulation on the negative side.

Inasmuch as the insulated feeders are enclosed in the air-tight tubes or gas pipes, and free from all atmospheric conditions, and the tubes also exceedingly well insulated, it reduces the possibility of the current breaking through this insulation to a minimum, and makes the K. & K. System much more reliable than overhead wires, or any other system yet produced.

Thus it will be seen that it is but natural to expect that the public is ever alert for the best means for rapid and safe transportation, and it is but a question of a very short time when the K. & K. System will prevail and the public will attain that for which they have so long waited.

We would be pleased to enlighten you further regarding this system, and request that you drop us a line.

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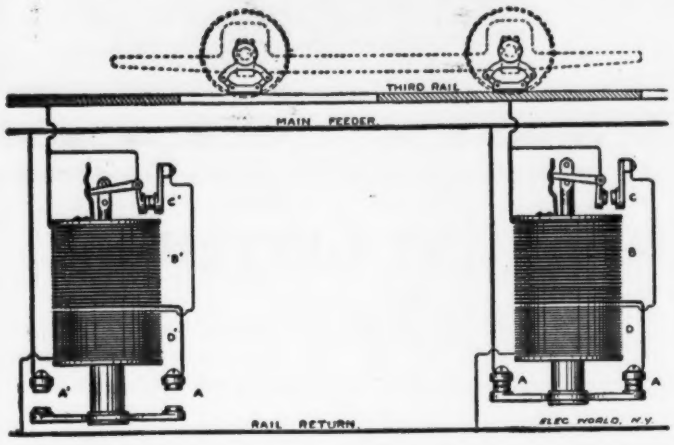

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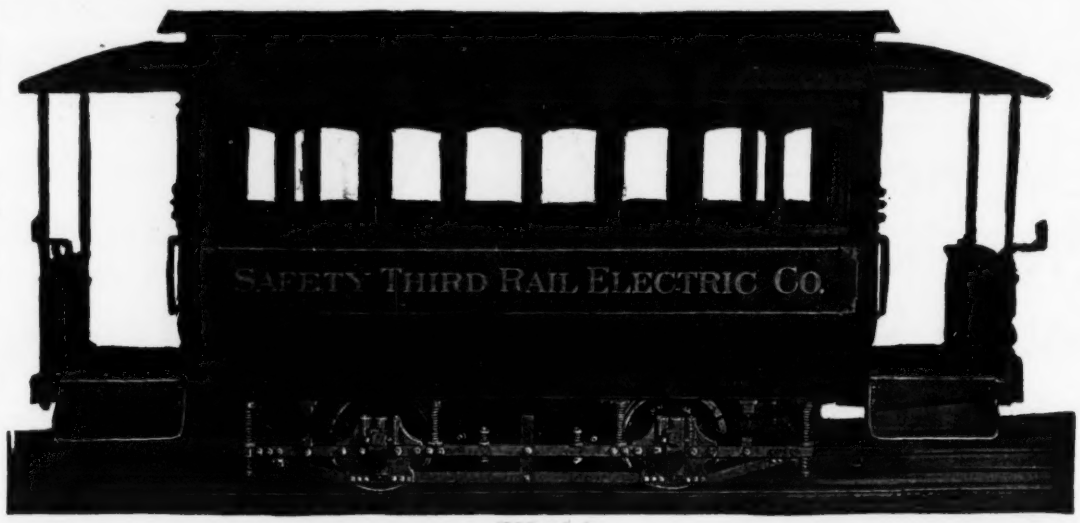

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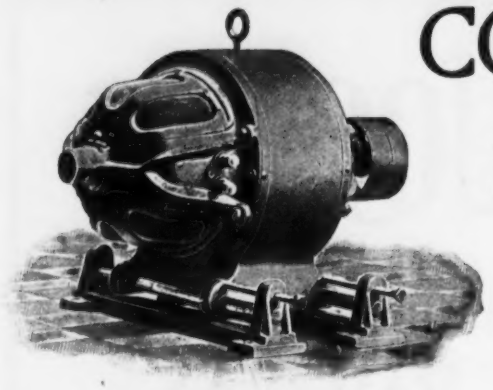

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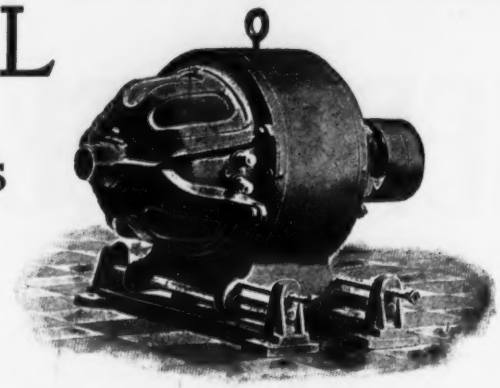

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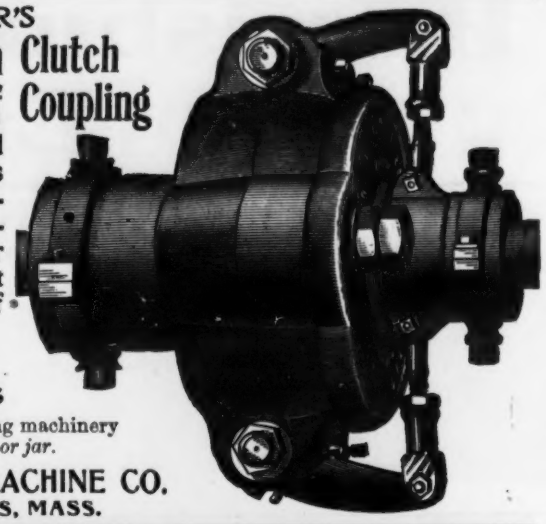

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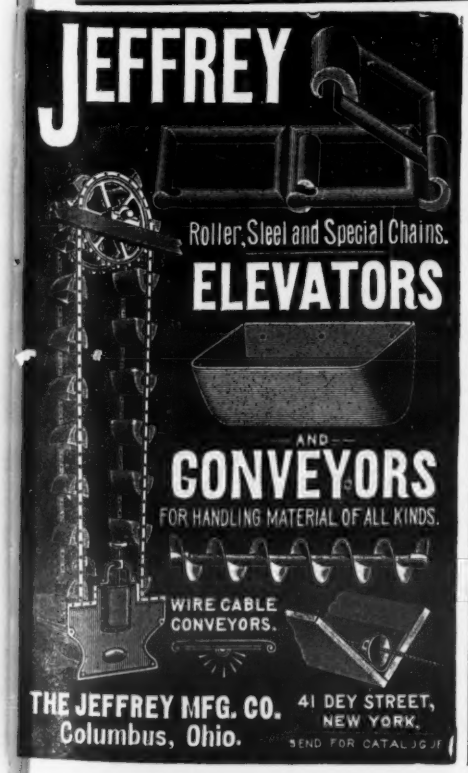

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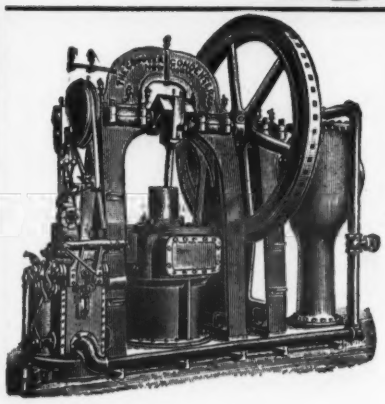

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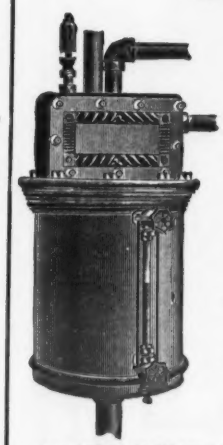

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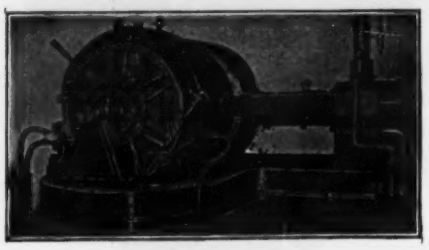

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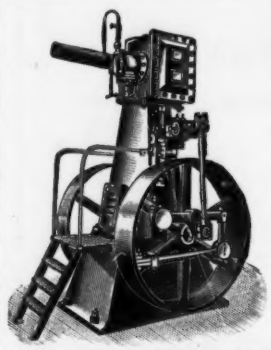

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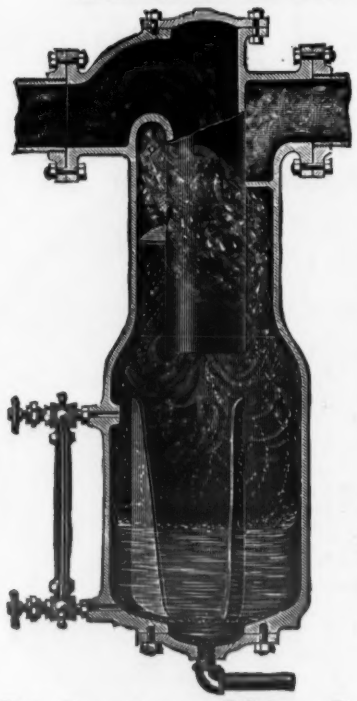

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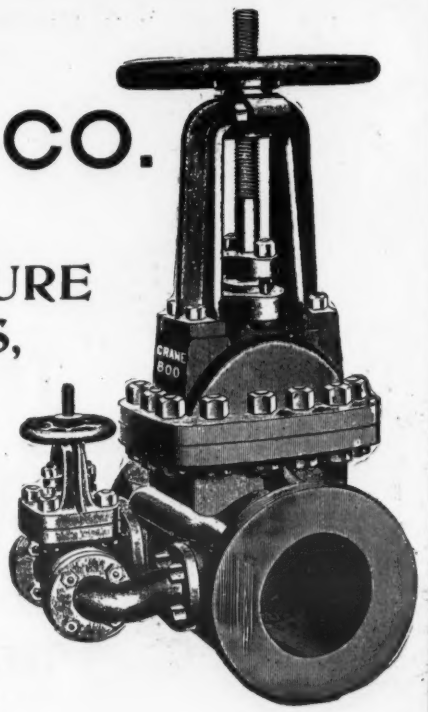

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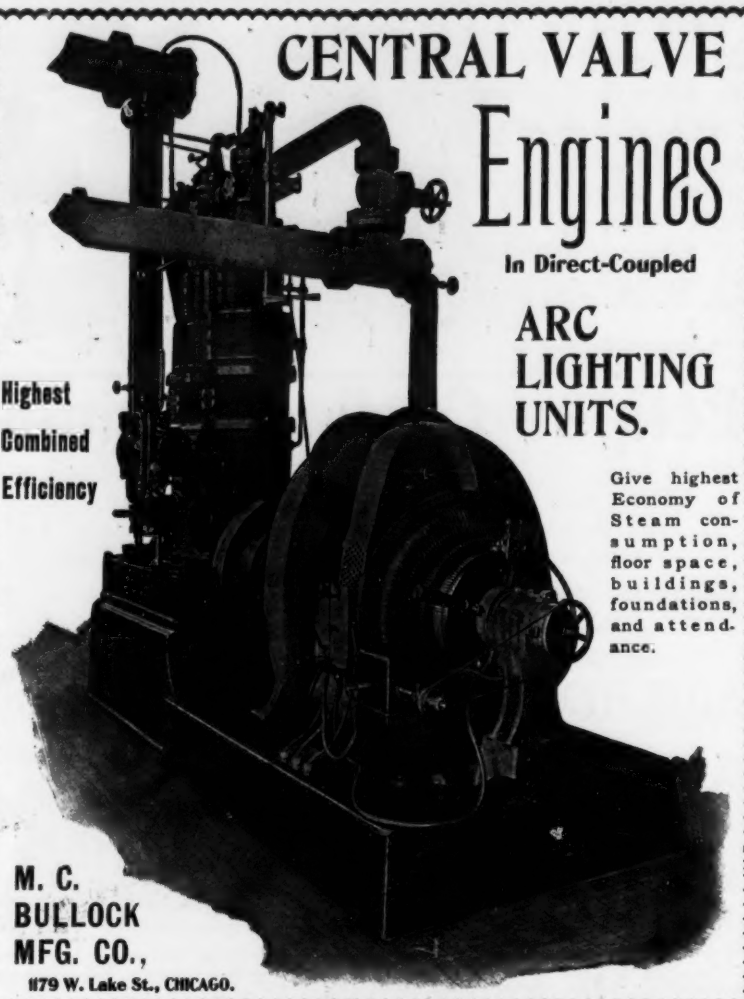

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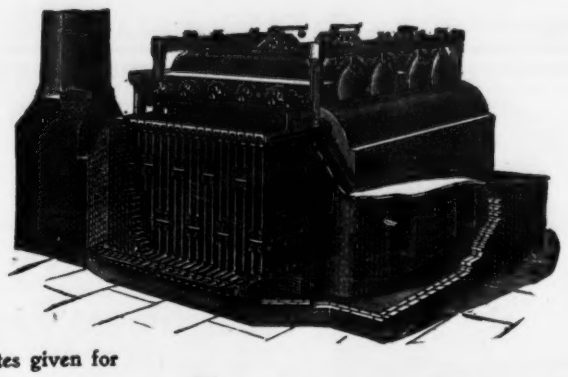

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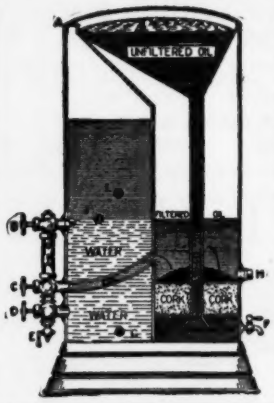

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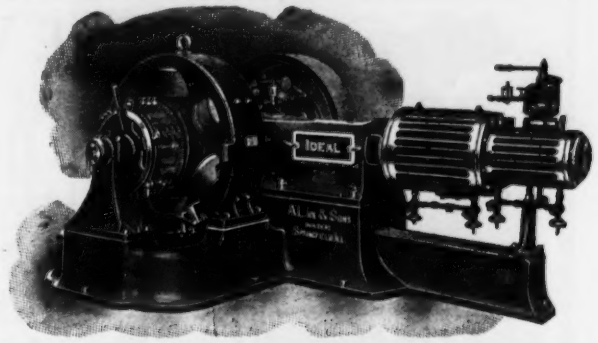

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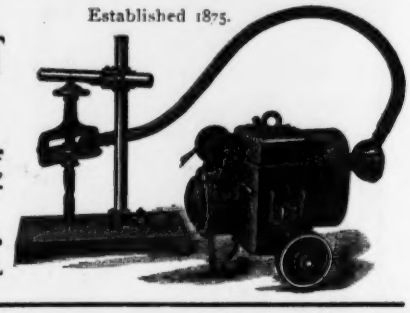

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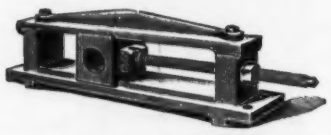

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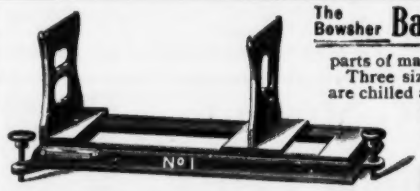

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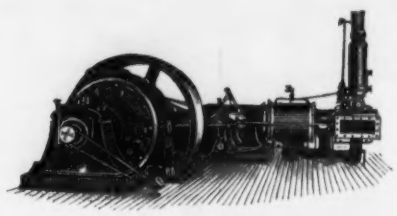

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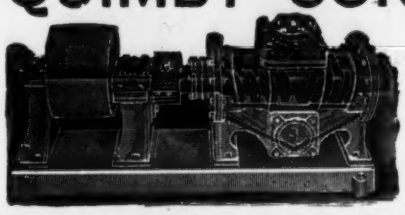

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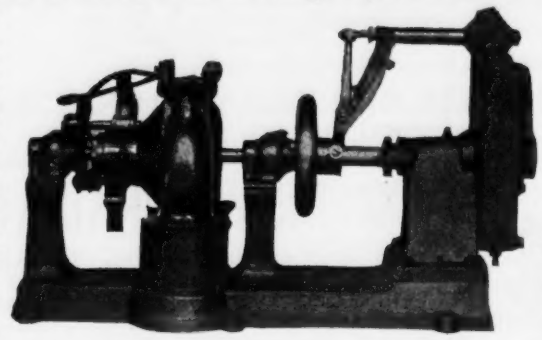

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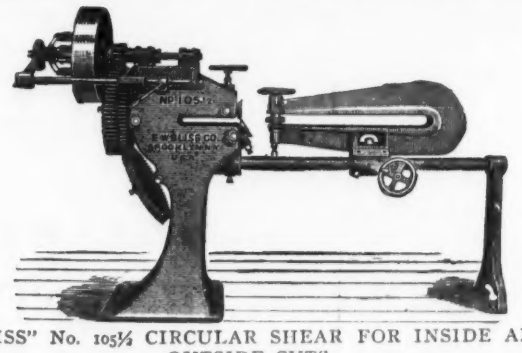

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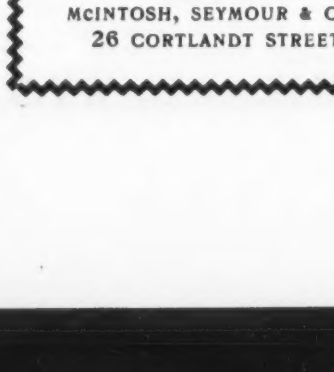

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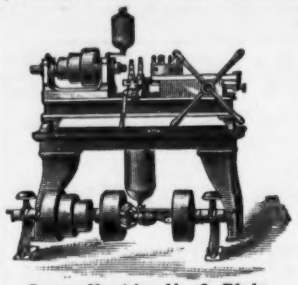

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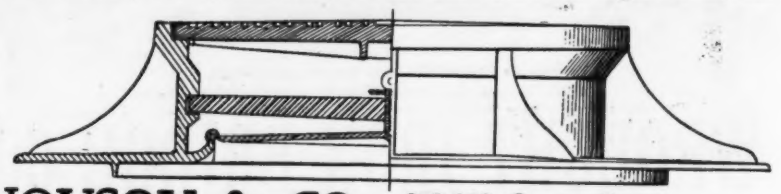

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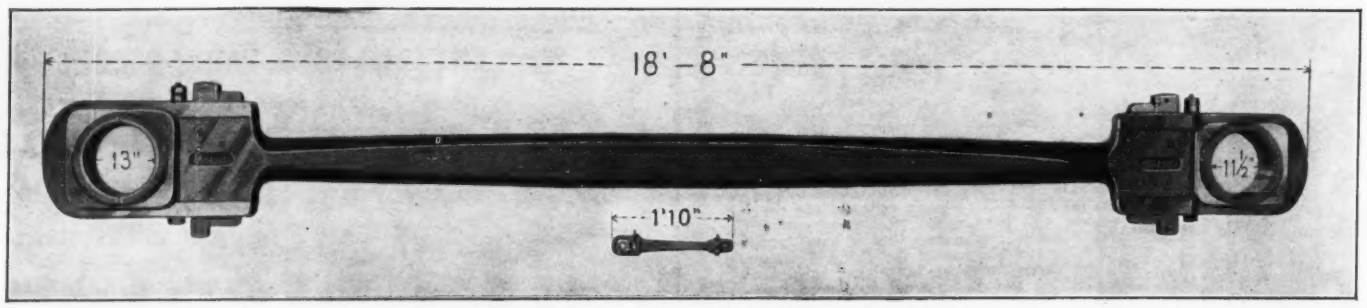

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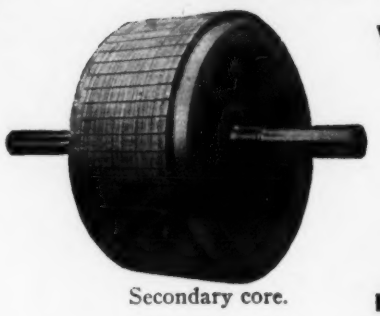

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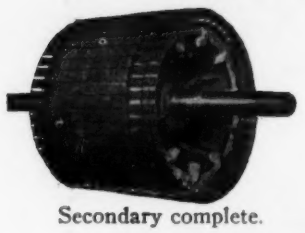

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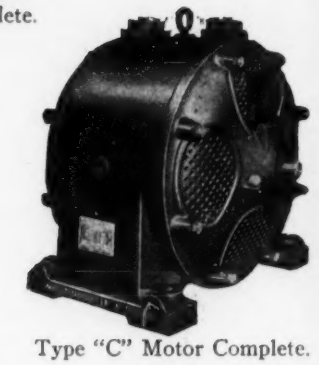

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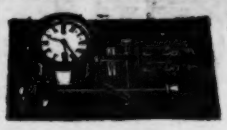

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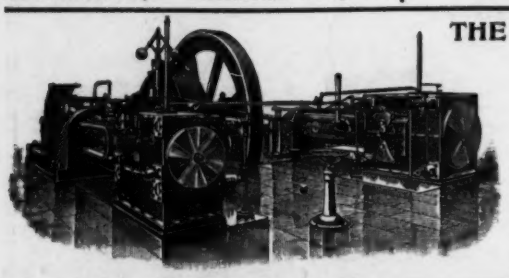

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